

# THE ADULT ARCTOPSYCHIDAE AND HYDROPSYCHIDAE (TRICHOPTERA) OF CANADA AND ADJACENT UNITED STATES

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## ABSTRACT

*Of the six species of Arctopsychidae here reported from Canada and adjacent States of the United States, three belong to each of Arctopsyche McLachlan and Parapsyche Betten. Of 72 species of Hydropsychidae, 24 belong to Cheumatopsyche Wallengren, 42 to Hydropsyche Pictet, three to Macrostemum Kolenati, and one each to Potomyia Banks, Diplectrona Westwood, and Aphropsyche Ross.*

*Keys are provided (for males, and females where possible) to genera and species. For each species the habitus is described in some detail, with diagnostic statements for the genitalia. Also included are brief statements about way of life and known distribution. Distributions are mapped, and genitalia are illustrated.*

## RÉSUMÉ

*Soixante et dix-huit espèces d'Arctopsychidae et d'Hydropsychidae (Trichoptera) sont mentionnées pour le Canada et les états frontaliers des États-Unis, représentant les genres suivants: Arctopsyche McLachlan (3), Parapsyche Betten (Arctopsychidae) (3), Cheumatopsyche Wallengren (24), Hydropsyche Pictet (42), Macrostemum Kolenati (3), Potomyia Banks (1), Diplectrona Westwood (1) et Aphropsyche Ross (1).*

*Des clés d'identification au genre et à l'espèce (pour les mâles, et les femelles lorsque possible) sont présentées par l'auteur. Un habitus ainsi qu'une description diagnostique des pièces génitales sont donnés pour chacune des espèces. Une description résume ce qu'il y a de connu sur l'histoire naturelle et la répartition géographique de ces espèces. Les aires de distributions et les pièces génitales sont largement illustrées.*

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## INTRODUCTION

This paper brings together information about all species of Arctopsychidae and Hydropsychidae presently known from Canada, or with the potential to be found in Canada. Consequently, all species of the two families recorded from contiguous States of the United States, but not yet from Canada, are also included here.

The Hydropsychidae is one of the larger families of Trichoptera, world-wide, with 72 species recorded here. These species are distributed among three subfamilies and six genera. The Arctopsychidae, on the other hand, is a small family confined to the Holarctic region and its fringes in south Asia. There are six species recorded here.

Characterisations of supra-specific taxa are abridged from Schmid (1980).

The key to genera is translated from Schmid (1980). For a key to genera of larvae, Wiggins (1977) should be consulted. Keys to species are original, with the exception of that to *Cheumatopsyche* which is partially adapted from Gordon (1974). These keys make fullest possible use of the illustrations, and have been kept as simple as possible: use of more than two characters per couplet has been avoided where possible; for most couplets, only one character is used.

In the text for each species a general habitus description is presented in some detail. This is based on the male, with mention of the female only when she is significantly different. Regarding genitalia, a diagnostic statement only is presented, which makes reference to those characters which will ensure correct recognition of a species in conjunction with the illustrations. The male and female (where known) genitalia of each species are fully illustrated. Notes about way of life and known distribution (with maps) complete the presentation for each species.

Within subfamilies the genera are presented in alphabetical order. Within the genera the species are also presented in alphabetical order, except where the genus has been subdivided to species groups and subgroups, when the alphabetical ordering is used only within the lowest grouping. This latter arrangement is used in *Cheumatopsyche* and *Hydropsyche*. In *Cheumatopsyche* I use the infra-generic group names of Gordon (1974). In *Hydropsyche* I use a numbering system for the groups, and a letter designation for the subgroups.

At the beginning of each species treatment (as also for the treatment of each genus, subfamily, and family) a brief synopsis of the synonymy attaching to that taxon is presented, with citations of the more important papers relevant to the history of the taxon. For a complete listing of literature for each taxon, up to 1961 inclusive, Fischer (1963; 1972) should be consulted.

Statements about colour are based on alcohol-preserved material. With such material, fading may occur over time, and wing and body hairs may be lost. Wing colouration, therefore, is based on membrane colour. This is the normal situation with fluid-preserved material, which

is usual in bulk collecting especially.

Species recognition in adults is based almost entirely on male and female genitalia. In the males I follow Snodgrass (1957:35) in considering the aedeagus to be the entire evertible assemblage located between the claspers (inferior appendages). I also prefer to use the term *clasper*, rather than *inferior appendage*, as it has the merit of brevity and of describing the apparent function of the appendage in question. The abdominal segments are referred to by use of roman numerals, counting from the abdomen-thorax junction.

From the illustrations of genitalia I omit setae or hairs except in instances where they may be of use in identification of a given species; otherwise they simply clutter the drawing and obscure other features. The genitalia of many species are, however, well invested with setae or hairs.

One final point to note, regarding descriptions or characterisations, is the use of the singular and plural. Several components of the genitalia are paired but, in certain views only one member of a pair is visible. When one member only is visible the singular is used. When both are visible, the plural is generally used. Reference to the wings and legs is normally on the basis of one member of each pair.

## TECHNIQUES

Refer to Nimmo (1971) for details about collection, preservation, and preparation of material for examination.

## GEOGRAPHICAL DISTRIBUTION

A distribution map, or maps, is presented for each species dealt with here. For those species presently known from Canada a detailed map of the Canadian distribution is given. An inset map of North America presents a by state/province overview of the total known distribution in North America. For those species not yet recorded from Canada only the overall North American map is presented.

The State records for the United States portion of the North American maps are derived from the literature. Most of the detailed Canadian records are new to the literature and are derived from examination of museum or newly collected material. Such detailed records as were obtained from the literature are considered to be trustworthy and no distinction is made on the maps.

Apart from the transcontinental species the fauna may be divided into those relatively few species known from the Rocky Mountain foothills and west, and the great bulk of species which occur east of these foothills. A very few of these last are apparently restricted to the Great Plains. The remainder are centred on eastern North America with extensions to the north-west, to the north-east, and to the south, or combinations of these. Some species appear to be confined to the environs of the Appalachians, or to the southern fringes of the Great Lakes, with or without extensions southward along the valley of the Mississippi River. Many species are still too poorly known for useful speculation regarding their distribution patterns.

Other than records of a few species from northern Québec, these two families appear to be limited northwards by the tree line.

A single, transcontinental, species is holarctic in total distribution, being known from Eurasia as far west as northern Europe.

## NOTE ADDED IN PRESS

Schefter, Wiggins, & Unzicker (1986) recently synonymized names of two species dealt with here: *Hydropsyche jewetti* Denning (= *H. cockerelli* Banks); and *Hydropsyche riola* Denning (= *H. alhedra* Ross). Similarly, Schefter & Unzicker (1984) synonymised *Hydropsyche bifida* Banks with *H. morosa* Hagen.

These synonymizations may be correct; indeed I am inclined to accept that they are. However, in course of preparation of this paper, I encountered no material which might support the above synonymizations, and prefer, for present purposes, to leave the text as originally written. Thus, I have inserted guiding notes, in the appropriate parts of the text, relating to this particular note.

## THE FAMILY ARCTOPSYCHIDAE MARTYNOV

Arctopsychidae Martynov, 1924:25; Schmid, 1968:4; Schmid, 1980:51.

Arctopsychinae (Hydropsychidae); Milne, 1940:13, 19; Flint, 1961:5; Ross, 1956:10; Wiggins, 1977:93.

*Description.*— Females distinctly larger, more robust than males. Ocelli absent. Maxillary palpi of five articles; with basal two articles very short, sub-equal; article four slightly shorter than article three; article five long, flagellate. Antennae thickened, especially in male; with short, globular scape. Spurs large; spur formula 2,4,4. Fore- and hind-wings (Fig. 2) virtually identical in individuals and between sexes; nearly oval in outline but hind-wings with anal edge evenly rounded. Venation similar in the two genera dealt with here: fl-V present in fore-wings, fl-III and fV present in hind-wings. Fore-wings with discoidal, median, and thyridial cells closed; thyridial cell especially long; cross-veins C-Sc, Sc-R1, and R1-R2+3 present; Cu2 terminated on A rather than on anal edge of wing; postcostal cell very large. Hind-wing with cross-veins C-Sc and Sc-R1 present; with four separate anal veins.

*Genitalia.* Male. (Fig. 7–9, 25–28). Segment IX well developed dorsally. Preanal appendages free or fused to segment X. Intermediate appendages also free or fused to each other. Claspers (inferior appendages) large or small, bipartite. Aedeagus large, located high in the abdomen composed of tubular phallosome with invaginated small, membranous, erectile endotheca.

*Genitalia.* Female (Fig. 11–12, 29–30). Segments X and XI short. Tergite VIII very large; lateral edges produced quite far ventrad. Sternite VIII correspondingly reduced, with posterior edge terminated in two large lobes. Segment IX absent. Segment X enclosed by lobes of Sternite VIII, short, simple, without clasper receptacles; postero-dorsal edge with two small tubercles, each with slender brush of very long hairs. Segment X with large, postero-ventral, membranous vulval scale. Ano-vaginal opening on posterior end of segment X.

The Arctopsychidae are very closely related to the Hydropsychidae, and some authors regard it as a subfamily of the Hydropsychidae (Wiggins, 1977). Based on Schmid (1968), and taking account of Smith (1968), the Arctopsychidae encompass two known genera and a minimum of 43 species worldwide. The family is oriental and holarctic in overall distribution, with most species concentrated in a zone extending from the Himalaya to Japan. Eleven species (one of which is holarctic) are currently recognised in North America, with five known to occur in Canada and a sixth possibly to be found here. Both genera occur in Canada, with three and two (three?) species of each represented.

## Key to genera of Arctopsychidae of Canada

- 1a Eyes glabrous. Male genitalia protuberant, not recessed into segment VIII.  
Tibia and tarsus of female middle leg flattened, enlarged .....  
..... *Arctopsyche* McLachlan, p. 5
- 1b Eyes hairy. Male genitalia barely protuberant, recessed into segment VIII.  
Tibia and tarsus of female middle leg not flattened, not enlarged ..... *Parapsyche* Betten, p. 14

Genus *Arctopsyche* McLachlan

Maps 1–3; Fig. 2, 7–24

*Arctopsyche* McLachlan, 1868:300; Betten, 1934:179, 180; Milne, 1936:65; Flint, 1961:6; Schmid, 1968:21, 29, 32; Wiggins, 1977:98; Schmid, 1980:52.

**Description.**— Eyes glabrous. Third article of maxillary palpi twice as long as wide; not much longer than fourth. Spur formula 2,4,4. Tibia and tarsus of female middle leg enlarged, flattened, fringed with hairs. Discoidal cell of fore- and hind-wings (Fig. 2), and median cell of fore-wing small.

**Genitalia.** Male. (Fig. 7–10, 13–16, 19–22). Segment IX nearly as large as VIII, not recessed within VIII. Preanal appendages free (Fig. 7, 9); long, narrow, rounded. Intermediate appendages (Fig. 7, 9) stout, long blades; single or paired; simple or with dentitions. Segment X entirely membranous, either very short or as long slender tube (Fig. 19, 20) depending on species group. Claspers (inferior appendages) (Fig. 7, 8) with two articles, reduced in size, complex; basal article massive, with dorsal lobe or spine and two or three ventral spines; distal article small, inserted between spines of basal article. Aedeagus (Fig. 10) large, stout, with recurved internal phallosomal sclerite.

**Genitalia.** Female. (Fig. 11–12, 17–18, 23–24). Postero-dorsal margin of segment X with inconspicuous flange (Fig. 11). Segment XI developed basad.

In Canada *Arctopsyche* is represented by two species; one of these (*A. ladogensis*) is holarctic in distribution, being recorded in boreal regions from northwestern Europe to Newfoundland. A third species (*A. irrorata*) is presently known only from the southeastern United States but may eventually be recognised from eastern Canada. *A. grandis* is primarily a western montane species, but has been recorded from northwestern Québec.

**Key to known or potential species of *Arctopsyche* McLachlan of Canada**

- |         |   |                                       |
|---------|---|---------------------------------------|
| 1a      | Males (Fig. 7-10) .....   | 2                                     |
| 1b      | Females (Fig. 11-12) .....  | 4                                     |
| 2a (1a) | Segment X prominent, projected posterad of intermediate appendages (Fig. 19, 20) .....  | <i>A. ladogensis</i> (Kolenati), p. 7 |
| 2b      | Segment X not evident (Fig. 7, 13) .....  | 3                                     |
| 3a (2b) | Each member of intermediate appendage pair with single dorsal and ventral processes (Fig. 13, 15) .....                                       | <i>A. irrorata</i> Banks, p. 6        |
| 3b      | Each member of intermediate appendage pair with only one process .....  | <i>A. grandis</i> (Banks), p. 5       |
| 4a (1b) | Vulval scale with complex outline in ventral aspect (Fig. 12) .....   | <i>A. grandis</i> (Banks), p. 5       |
| 4b      | Vulval scale with relatively simple outline in ventral aspect (Fig. 18, 24); evenly tapered posterad .....                                    | 5                                     |
| 5a (4b) | Ventral surface of vulval scale with darker, w-shaped transverse line in ventral aspect (Fig. 24). Thorax and head purplish brown-black ..... | <i>A. ladogensis</i> (Kolenati), p. 7 |
| 5b      | Ventral surface of vulval scale without transverse darker line (Fig. 18). Thorax and head greyish brown .....                                 | <i>A. irrorata</i> Banks, p. 6        |

*Arctopsyche grandis* Banks

Map 1; Fig. 7–12

*Arctopsyche grandis* Banks, 1900:258; Milne, 1936:66 (*A. phryganoides* as synonym); Ross, 1938c:14; Schmid, 1968:54; Smith, 1968:109 (*A. inermis* as synonym); Wiggins, 1977:99.

*Arctopsyche phryganoides* Banks, 1918:21; Milne, 1936:66 (as synonym of *A. grandis*).

*Arctopsyche inermis* Banks, 1943:368; Smith, 1968:109 (as synonym of *A. grandis*); Schmid, 1968:54.

**Description.**— Male fore-wing length 12.56 mm; pale grey-brown with uniform faint irroration except for coalescence of pale areas along costal edge; female irroration more evident. Hind-wing faintly tinted golden brown; grey-brown in female. Antennae brown-cream; basal 19 flagellar annuli of male each with simple black bands; 17–18 in female. Vertex dark brown. Spurs brown; lateral member of middle leg pairs notably shorter than mesal companions. Thorax dark brown, to pale yellow-brown laterally. Legs pale brownish yellow.

**Genitalia.** Male. (Fig. 7–9). (Specimen from Wildhorse camp, Ya Ha Tinda Ranch road, Alberta). Males distinguished by apparent lack of segment X (Fig. 7, 9); by dorsal lobe of clasper basal article broad in lateral aspect, angled posterad (Fig. 7); and by ventral lobe of clasper basal article terminated in several acuminate teeth in ventral aspect (Fig. 8).

**Genitalia.** Female. (Fig. 11–12). (Specimen from Wildhorse camp, Ya Ha Tinda Ranch road, Alberta). Females distinguished by complexity of vulval scale in ventral aspect; scale with semi-circular posterior edge (Fig. 12) terminated laterally by lateral processes; anterad of processes scale markedly constricted and anterad of constriction scale abruptly expanded to greater width.

**Biology.**— British Columbia and Alberta records give flight season extremes of June 6 to August 27, and May 26 to August 12 respectively, with definite peak indicated for July as a whole. Smith's (1968) records from Idaho conform to much the same pattern. He adds that the commonest life stages in winter were mature larvae, with pupation occurring from April to May. He concludes that this species has a two-year life cycle. My records indicate that adults emerge from the largest mountain and foothill rivers, from smaller, riffled foothill streams, from turbulent mountain streams, and from all intermediate types of flowing water in mountain and foothill country. Adults have also been collected from clear, riffled, cool streams in low-altitude terrain of little relief. Larvae appear to be, ecologically, very diverse or tolerant. Wallace (1975a) presents information in support of the predaceous nature of larvae of *Arctopsyche*. Mecom (1972) contends that *A. grandis* larvae are carnivorous in summer months, but primarily phytophagous, diatom feeders, or detritivores at other times.

**Distribution.**— Recorded from the Yukon and western Northwest Territories in Canada, to California and New Mexico in the United States, with one record from northwestern Québec (Map 1) in Canada; excepting the Québec record, this species appears to be confined to the Cordillera west of the Great Plains.

### *Arctopsyche irrorata* Banks

Map 2; Fig. 13–18

*Arctopsyche irrorata* Banks, 1905b:217; Milne, 1936:66.

**Description.**— Male fore-wing length 14.43 mm; medium grey-brown; randomly irrorate throughout, except more regular alternate hyaline and coloured patches along costal edge and posterad as far as Rs. Hind-wing tinted grey-brown (very pale). Antennae pale orange-brown; each annulus with deep chocolate-brown band on dorsal and lateral surfaces, at right-angles to axis of annulus; scape with rectangular patch of dark brown laterally. Vertex pale orange-brown to red-brown. Spurs red-brown; lateral member of each pair shorter than mesal companions. Thorax deep red-brown dorsally, pale straw to cream laterally. Legs pale red-brown. Female overall darker than male.

**Genitalia.** Male. (Fig. 13–16). (Specimen from Citico Ck, Monroe Co., Tennessee, USA). Males distinguished by each member of intermediate appendage pair bifid (Fig. 13, 15); by apparent lack of segment X; by ventral lobe of clasper single, not subdivided (Fig. 14), with distal hook turned dorsad in lateral aspect (Fig. 13); and by dorsal lobe of clasper directed dorsad, irregular in outline.

**Genitalia.** Female. (Fig. 17–18). (Specimen from Citico Ck, Monroe Co., Tennessee, USA). Females distinguished by vulval scale fairly regular in ventral outline (Fig. 18), straight-edged laterally, with central portion slightly raised, tapered posterad, and with semi-circular membranous lobe on distal edge.

**Biology.**— Flint (1961) records small larvae in early summer, mature larvae in fall, and adult flight season as late May and June. Overwintering is by mature larvae. He adds that larvae live in fairly large streams up to 25 m wide, and 1 m deep; the water is clear, cold, with gravel and boulder substrate. He also records abundance of larvae in shallow water falling rapidly over bedrock. Both animal and plant material are consumed, with animal matter predominating. Wallace (1975a) provides full details about retreat and net structure, and

seasonal feeding habits.

*Distribution.*— To date this species is recorded definitely only from Tennessee, and North & South Carolina (Map 2). Ross (1944) records the species from 'eastern States and eastern Canada', hence its inclusion here. But as, in the same sentence, he also includes *A. ladogensis*, this 'record' may simply result from imprecise wording. More definite records could not be found to substantiate Ross' statement.

*Arctopsyche ladogensis* (Kolenati)

Map 3; Fig. 19–24

*Aphelocheira ladogensis* Kolenati, 1859:145, 147, 165, 183, 201.

*Arctopsyche ladogensis*; McLachlan, 1868:301; Milne, 1936:66, 67; Schmid, 1968:56.

*Arctopsyche ladogensis* form. *ramosa* McLachlan, 1878:379; Milne, 1936:67.

*Arctopsyche ladogensis* form. *obesa* McLachlan, 1868:301; Milne, 1936:67.

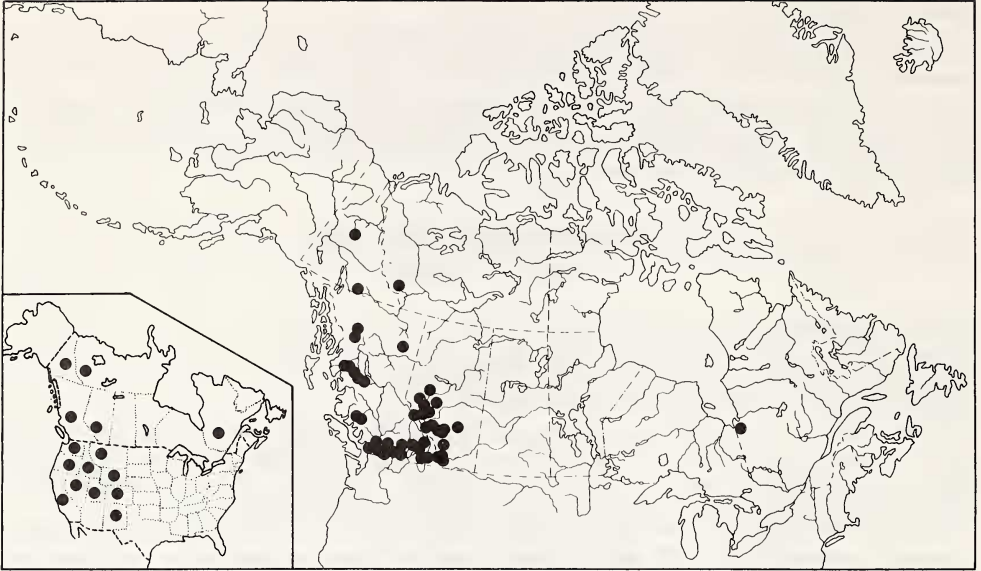
*Description.*— Male fore-wing length 11.23 mm; light purplish brown, no pattern evident. Hind-wing palely tinted brown. Antennae pale yellow-brown; basal 19 flagellar annuli with at least trace of darker encircling band; 14 in female. Vertex deep red-brown. Spurs brown; lateral member of middle leg pairs markedly shorter than mesal companions. Thorax very deep purplish brown-black, to paler, mottled red-brown laterally. Legs brown, to straw distally.

*Genitalia.* Male. (Fig. 19–22). (Specimen from House R., Hwy 63, S of Ft McMurray, Alberta). Males distinguished by segment X prominent (Fig. 19, 20); by much smaller clasper with finger-like dorsal lobe accompanied by spine immediately anterad (Fig. 19); and by distinct dorsal spine on distal edge of aedeagus (Fig. 22).

*Genitalia.* Female. (Fig. 23–24). (Specimen from House R., Hwy 63, S of Ft McMurray, Alberta). Females distinguished by vulval scale simple, tapered, with slight mesal extension of posterior edge (Fig. 24); and by transverse line of darker colour in form of a W in ventral aspect.

*Biology.*— Flint (1961) records larvae of this species from clear, cold streams of up to 25 m width and 1 m depth, on gravel or boulder beds. Retreat and net are typical for the genus. Mature larvae are recorded in August and May, and are apparently the overwintering stage. Pupation occurs in late May or June. Flight records are for June (Flint, 1961). Records available to me from Canada give a flight season from May 12 to August 18, with the bulk in June and July. I have records, from northwestern Canada, of adults taken adjacent to rivers of 75 m width or more.

*Distribution.*— In North America this circumboreal species is known from western Alaska to Newfoundland, the northeastern United States, and Michigan (Map 3). From the Map one might conclude that the species is limited northward by tree line.

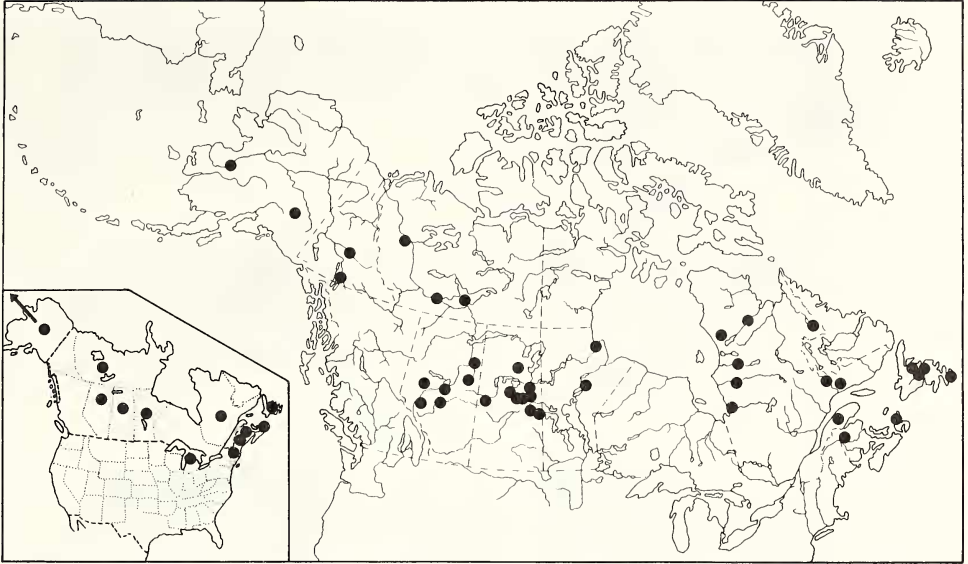


Map 1. Collection localities for *Arctopsyche grandis* (Banks) in Canada, with known distribution in North America by state or province.



Map 2. Known distribution of *Arctopsyche irrorata* Banks in North America, by state.





Map 3. Collection localities for *Arctopsyche ladogensis* (Kolenati) in Canada and Alaska, with known distribution in North America by state or province.

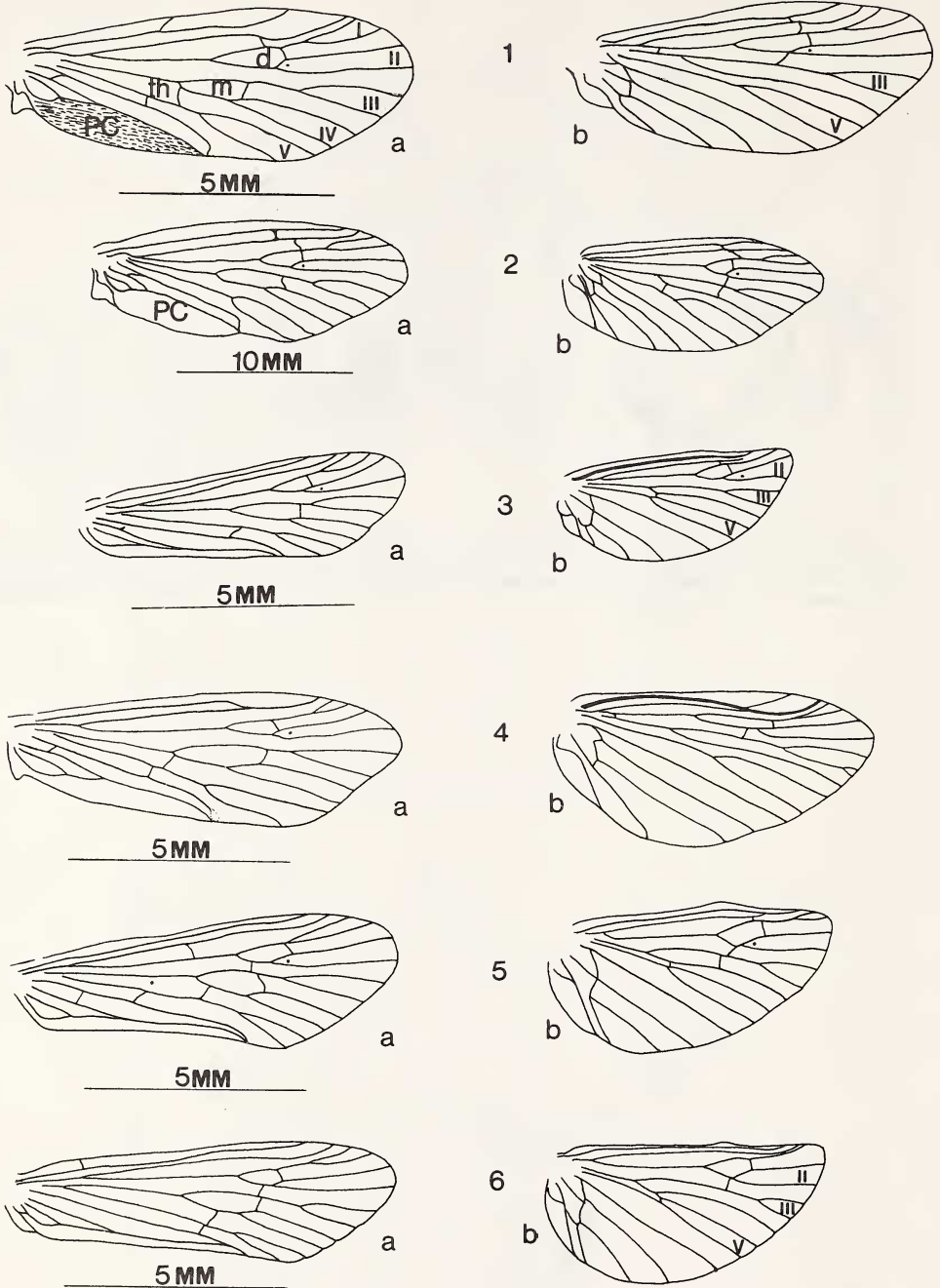


Fig. 1-6. Wing venation, males. 1, *Apropsyche doringa* (Milne). 2, *Arctopsyche irrorata* Banks. 3, *Cheumatopsyche pettiti* (Banks). 4, *Diplectrona modesta* Banks. 5, *Hydropsyche alhedra* Ross. 6, *Potamyia flava* (Hagen). 'a' figures are fore-wings; 'b' are hind-wings. d, discoidal cell; m, median cell; th, thyridial cell; pc, postcostal cell.

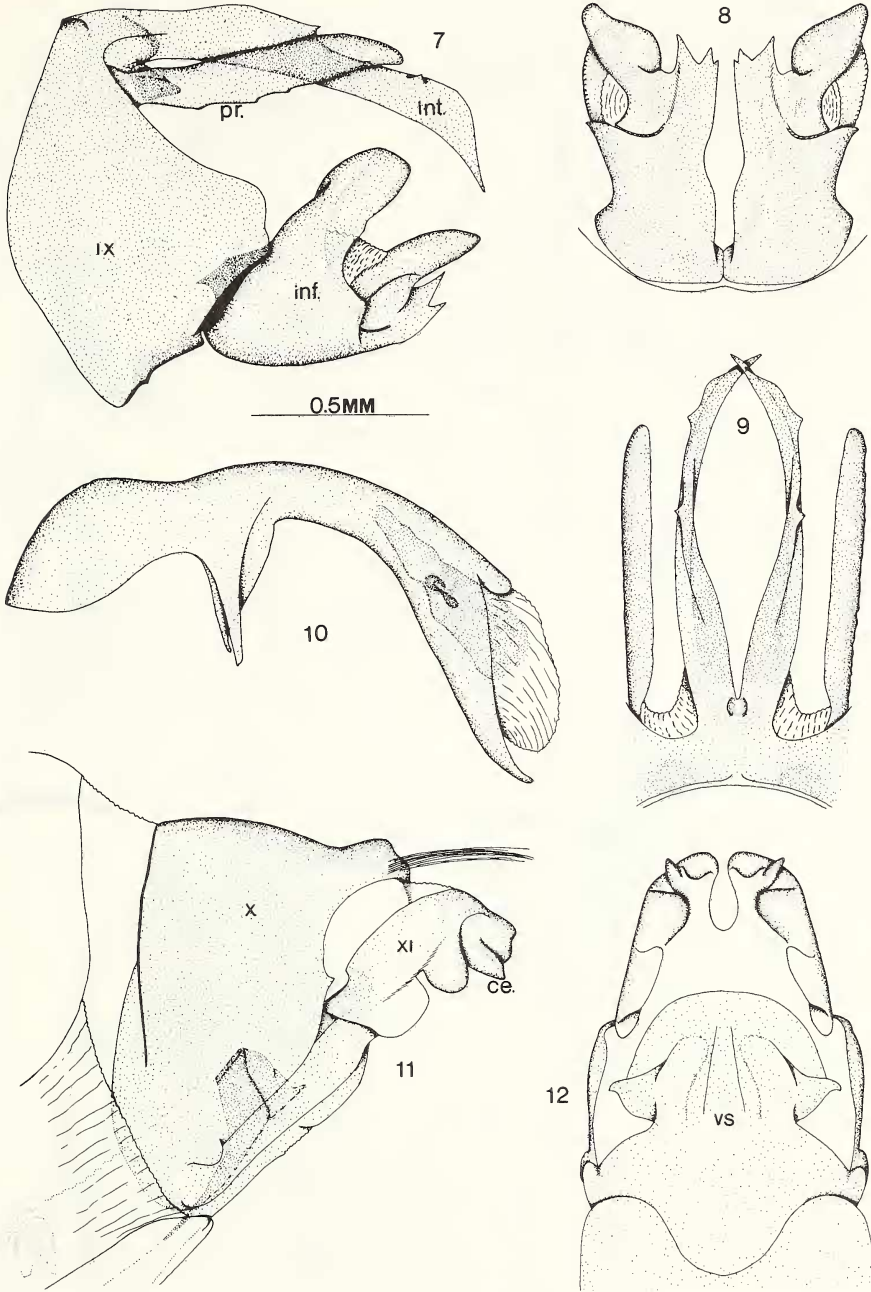


Fig. 7-12, *Arctopsyche grandis* (Banks): 7, genital capsule of male, lateral aspect; 8, claspers of male, ventral aspect; 9, intermediate and preanal appendages of male, dorsal aspect; 10, aedeagus of male, lateral aspect; 11, genital segments of female, lateral aspect; 12, genital segments of female, ventral aspect. inf, inferior appendage (clasper); int, intermediate appendage; pr, preanal appendage; ce, cercus; vs, vulval scale.

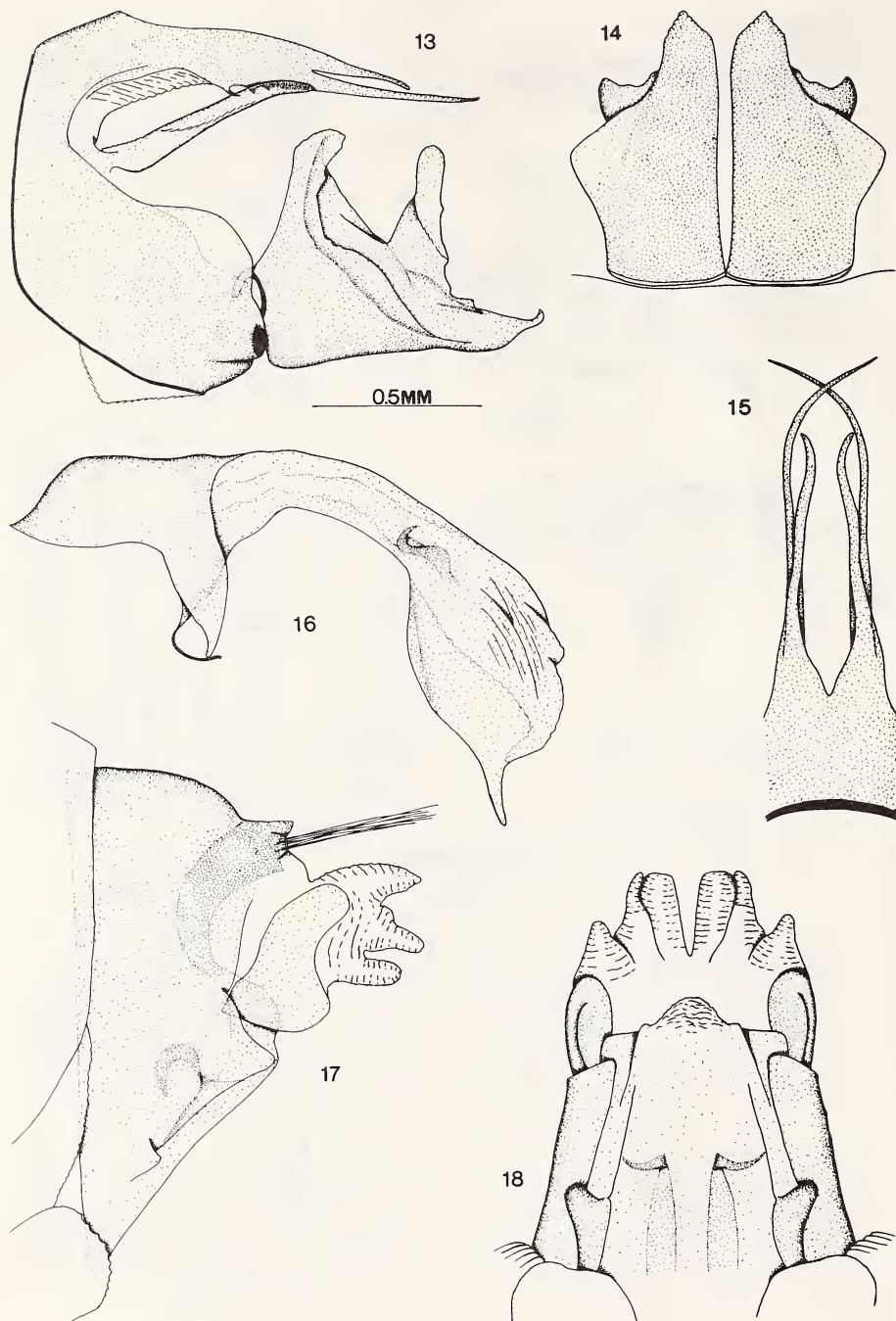


Fig. 13-18, *Arctopsyche irrorata* Banks: 13, genital capsule of male, lateral aspect; 14, claspers of male, ventral aspect; 15, intermediate appendages of male, dorsal aspect; 16, aedeagus of male, lateral aspect; 17, genital segments of female, lateral aspect; 18, genital segments of female, ventral aspect.

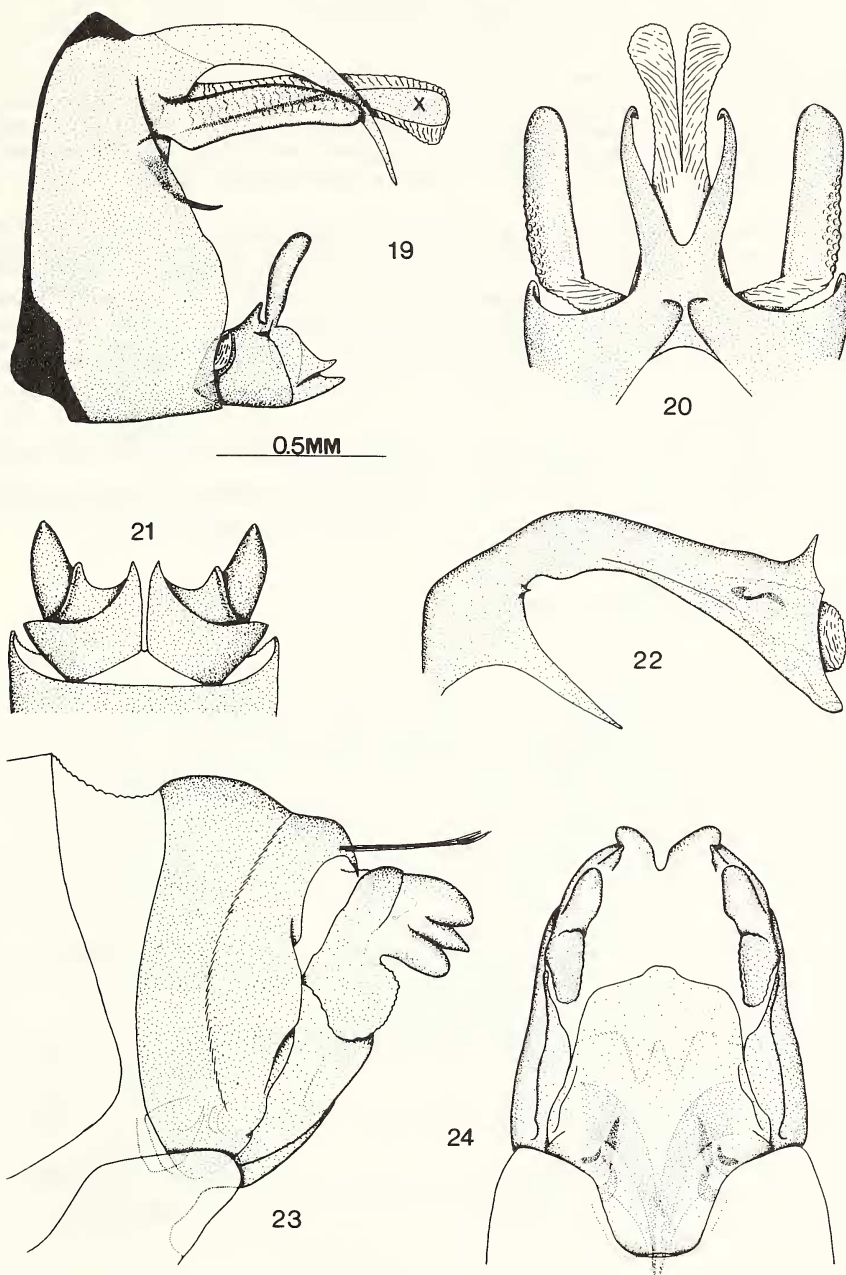


Fig. 19–24, *Arctopsyche ladogensis* (Kolenati): 19, genital capsule of male, lateral aspect; 20, genital capsule of male, dorsal aspect; 21, claspers of male, ventral aspect; 22, aedeagus of male, lateral aspect; 23, genital segments of female, lateral aspect; 24, genital segments of female, ventral aspect.

Genus *Parapsyche* Betten  
Maps 4–6; Fig. 25–43

*Parapsyche* Betten, 1934:179, 181; Schmid, 1968:26, 31, 60; Wiggins, 1977:114; Schmid, 1980:53.

**Description.**— Eyes densely clothed with long hairs. Palpi little longer than in *Arctopsyche*. Third article of maxillary palpi at least three times longer than wide; with noticeable bulge on mesal face. Spur formula 2,4,4. Tibia and tarsus of female middle leg not flattened, not enlarged, not fringed with hairs. Hind leg femur very long, tarsi reduced, especially in female. Venation identical to that of *Arctopsyche* except discoidal and median cells of fore-wing distinctly longer.

**Genitalia.** Male. (Fig. 25–28, 31–35, 38–41). Segment IX rather small; partly recessed into segment VIII; short, with dorsal part prominent due to lower position of intermediate appendages (Fig. 25). Preanal appendages closely blended with base of intermediate appendages apparently little more than scars. Intermediate appendages large, horizontal, slightly sclerotised blades; fused basally (Fig. 26) or throughout most of their length (Fig. 40); connected to aedeagus by two clearly visible internal straps (Fig. 25, 26, 28). Claspers (inferior appendages) large, directed somewhat postero-dorsad (Fig. 25); with two articles. Basal article of clasper large; distal article on apex or middle of basal article; articles partly fused (Fig. 25, 27). Aedeagus with tubular phallosome, and membranous, erectile endotheca with external, paired phalotremal sclerites curved basad (Fig. 28). Phallosome surmounted by dorsal lobe, a prolongation of postero-dorsal margin of basal phallosome.

**Genitalia.** Female. (Fig. 29–30, 36–37, 42–43). Very similar to *Arctopsyche*. Dorso-lateral posterior margin of segment X not flanged (Fig. 29). Segment XI produced less prominently basad.

In Canada *Parapsyche* is represented by three species, two of which are western cordilleran, and the third eastern, in distribution. The larvae of all three species are known.

**Key to species of *Parapsyche* of Canada**

- |    |   |    |
|----|---|----|
| 1a | Males .....   | 2  |
| 1b | Females .....   | 4  |
| 2a | (1a) Intermediate appendages, in dorsal aspect (Fig. 26, 33), fused only at base .....  | 3  |
| 2b | Intermediate appendages fused throughout length (Fig. 40) .....   |    |
|    | ..... <i>P. elsis</i> Milne, p. 16  |    |
| 3a | (2a) Dorsal part of segment IX smoothly continuous with main body of segment, along posterior edge (Fig. 25). Western cordilleran species (Map 4) ..... | 14 |
|    | ..... <i>P. almota</i> Ross, p. 14  |    |
| 3b | Dorsal part of segment IX angled sharply posterad from main body of segment (Fig. 31). Eastern species (Map 5) .....                                    | 15 |
|    | ..... <i>P. apicalis</i> (Banks), p. 15   |    |
| 4a | (1b) Segment X slender in lateral aspect, small (Fig. 29, 36). Vulval scale medium to large in ventral aspect (Fig. 30, 37) .....                       | 5  |
| 4b | Segment X massive, wide in lateral aspect (Fig. 42). Vulval scale small in ventral aspect (Fig. 43) .....   |    |
|    | ..... <i>P. elsis</i> Milne, p. 16  |    |
| 5a | (4a) Vulval scale with triangular, membranous tip (Fig. 30). Eastern species (Map 5) .....  | 15 |
|    | ..... <i>P. apicalis</i> (Banks), p. 15   |    |
| 5b | Vulval scale with rounded tip, scarcely membranous (Fig. 37). Western cordilleran species (Map 4) .....   | 14 |
|    | ..... <i>P. almota</i> Ross, p. 14  |    |

*Parapsyche almota* Ross  
Map 4; Fig. 25–30

*Parapsyche almota* Ross, 1938a:119; Schmid, 1968:106–107, Fig. 84; Smith, 1968:105.

*Arctopsyche oregonensis* Ling, 1938:65; Ross, 1944:293.

**Description.**— Male fore-wing length 9.36 mm; grey-brown, heavily irrorate, with relatively large areas of hyaline membrane. Hind-wing faintly tinted brown. Female fore-wing more faintly irrorate; hind-wing grey-brown. Antennae

brown; about 19 basal flagellar annuli with dark brown band around each. Vertex red-brown; posterior warts pale. Spurs yellow; lateral member of middle leg pairs notably shorter than mesal companions. Thorax deep chocolate-brown to paler, grey-brown laterally. Legs straw-coloured.

*Genitalia.* Male. (Fig. 25–28). (Specimen from small, turbulent creek, Hwy 12, 12.7 km NE of Lilloet, British Columbia). Males distinguished by dorsal portion of segment IX smoothly continuous with main body of segment along posterior edge, in lateral aspect (Fig. 25); by intermediate appendages curved dorsad; by distal article of clasper short, conical in lateral aspect; and by intermediate appendages fused only at base (Fig. 26).

*Genitalia.* Female. (Fig. 29–30). (Specimen from small, turbulent creek, Hwy 12, 12.7 km NE of Lilloet, British Columbia). Females distinguished by segment X narrow (Fig. 29); and by vulval scale with distal half membranous, triangular (Fig. 30).

*Biology.*— Smith (1968) gives the Idaho flight season as April to October; my scanty Canadian records are within this range. Smith also concludes that medium to mature larvae are the overwintering stages; they are found on the small to medium rubble of small, clear creeks and streams. Of my two records from British Columbia one locality was a steep hill stream flowing over and around large boulders; the second stream was very shallow with fine gravel, at the outlet of a swamp.

*Distribution.*— This species is presently recorded from the Cariboo-Chilcotin district of west-central British Columbia, to Nevada and California (Map 4) and is probably confined to the Cordillera west of the continental divide. In Canada it is known only from western British Columbia in the southern coastal mountains.

### *Parapsyche apicalis* (Banks)

Map 5; Fig. 31–37

*Arctopsyche apicalis* Banks, 1908:266.

*Parapsyche apicalis*; Betten, 1934:181; Flint, 1961:8; Schmid, 1968:Fig. 108–110; Wiggins, 1977:115.

*Description.*— Male fore-wing length 8.58 mm; largely uncoloured membrane with scattered fragments of grey-brown. Antennae pale purplish brown with darker ring near distal end of each annulus. Vertex purple-brown, warts paler; red-brown in female. All spur pairs with lateral members shorter than mesal members. Thorax dark purple-brown dorsally; paler laterally, with some red-brown areas. Female thorax red-brown dorsally, to yellow-brown laterally. Legs yellow.

*Genitalia.* Male. (Fig. 31–35). (Specimen from Fox Point, Cumberland Co., Nova Scotia). Males distinguished by dorsal portion of segment IX sharply angled posterad (Fig. 31), in lateral aspect; by intermediate appendages more or less linear, sloped slightly ventrad; by distal article of clasper prominent, finger-like; and by intermediate appendages fused only at base.

*Genitalia.* Female. (Fig. 36–37). (Specimen from Baden, Ontario). Females differentiated by segment X narrow (Fig. 36); and by vulval scale broad, rounded distally, with little distal membrane (Fig. 37).

*Biology.*— Flint (1961) records the larvae as inhabiting cold (below 10°C), spring-fed brooklets only a metre or so wide and, occasionally, in rushing mountain streams several metres wide. The retreat and net are typical for the family. Overwintering is by larvae of several instars. Pupae occur throughout summer. Adults recorded from May 11 to October 1. Flint considers it possible that there are several generations per year, but without definite broods. The above seasonal information is derived from Massachusetts. Records from Canada give a flight season of May 7 to October 12; some agree with Flint's characterisation of the habitat as cold, spring-fed brooks. The remainder, however, indicate that larvae also inhabit warmer, larger streams.

*Distribution.*— In North America this species is confined to the eastern half of the continent (Map 5), ranging from Newfoundland and Ontario to Wisconsin, Tennessee, and North Carolina. In Canada the species is recorded from St John's, Newfoundland, to Lake Nipigon, Ontario, and south to the Niagara peninsula. An old record from Colorado almost certainly represents a misidentification of *P. almota* before that species was recognized by Ross – the two species are very similar as adults.

*Parapsyche elsis* Milne

Map 6; Fig. 38-43

*Parapsyche elsis* Milne, 1936:66, 67; Schmid, 1968:Fig. 111-113; Smith, 1968:107.

*Description.*— Male fore-wing length 12.4 mm; pale red-brown (grey-brown in female), very heavily irrorate. Hind-wing tinted pale grey-brown on distal third. Antennae brownish cream; each flagellar annulus encircled in distal quarter by brown band. Vertex brownish yellow except antero-mesal warts brown. Spurs brown; lateral member of middle and hind-leg pairs notably shorter than mesal companions. Thorax yellow-brown, to brownish cream laterally. Legs pale yellow-brown.

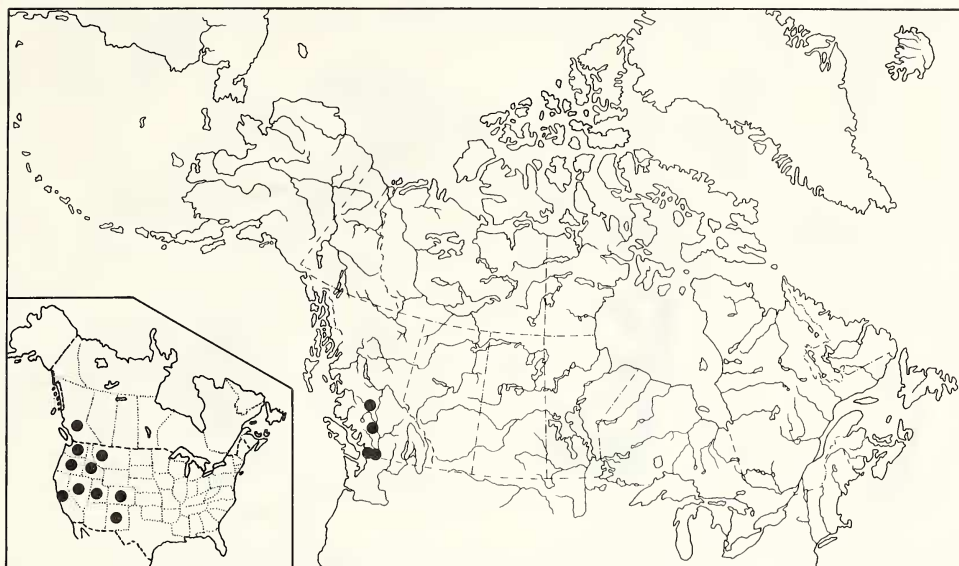
*Genitalia.* Male. (Fig. 38-41). (Specimen from Fiddle R., Hwy 16, Jasper National Park, Alberta). Males distinguished by dorsal portion of segment IX inclined posterad at about 45° to remainder of segment (Fig. 38); by intermediate appendages fused throughout length (Fig. 40), more or less linear, horizontal; by clasper with articles almost indistinguishably fused in lateral aspect (Fig. 38), massive, long; by phallosomal sclerites at tip of aedeagus (Fig. 41) small, with fine spines directed basad.

*Genitalia.* Female. (Fig. 42-43). (Specimen from Fiddle R., Hwy 16, Jasper National Park, Alberta). Females distinguished by massive, wide segment X in lateral aspect (Fig. 42); and by small vulval scale tapered sinuously distad, distal half trapezoidal, membranous (Fig. 43).

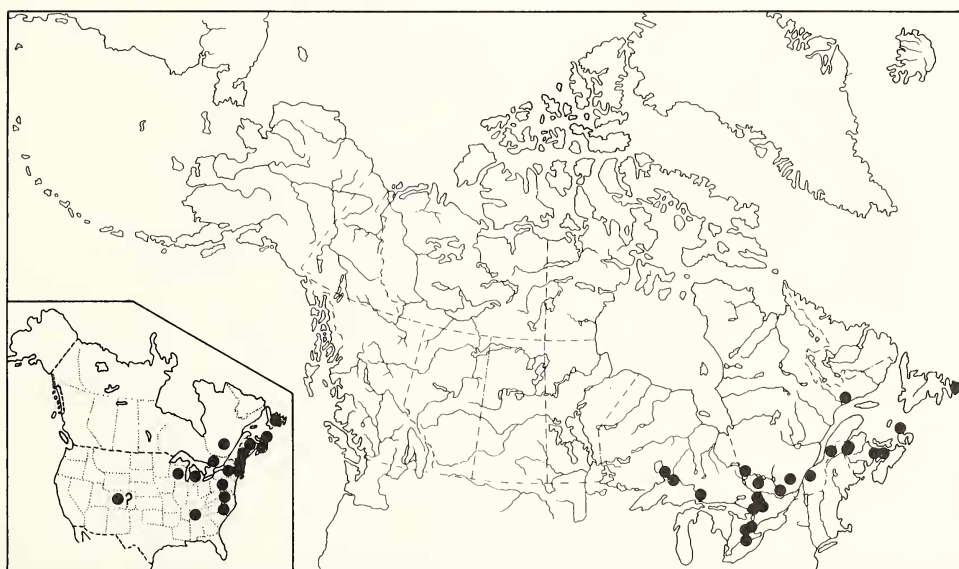
*Biology.*— Smith (1968) suggests that this species has a two-year life cycle. Overwintering is by young or nearly mature larvae; pupation evident in June and July. Larvae found in flowing waters ranging from small, clear creeks, to largest rivers with boulder beds; from hill streams to mountain torrents. Canadian records indicate flight season ranges from June 26 to September 8.

*Distribution.*— This species is (with one improbable exception) restricted to the western Cordillera of North America (Map 6), ranging from the Yukon and the Mackenzie Mountains of the Northwest Territories of Canada south to California and Utah. In Canada it is recorded generally from the various ranges of the western Cordillera as far north as the Ogilvie Mountains of the Yukon Territory. An isolated occurrence was recorded for North Carolina. Milne and Milne (1938) had only the five type specimens available at that time, to one of which this curious record is attributed. They make no comment on it. It seems to be so improbable that one is inclined to conclude that it is the result of locality mis-labelling of specimens at some earlier date.

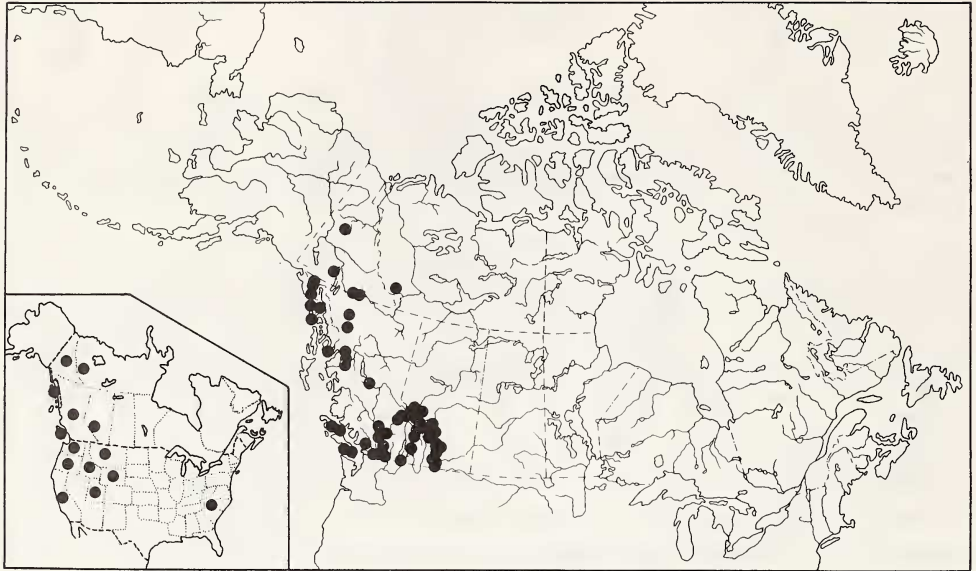




Map 4. Collection localities for *Parapsyche almota* Ross in Canada, with known distribution in North America by state or province.



Map 5. Collection localities for *Parapsyche apicalis* (Banks) in Canada, with known distribution in North America by state or province.



Map 6. Collection localities for *Parapsyche elsis* Milne in Canada and Alaska, with known distribution in North America by state or province.

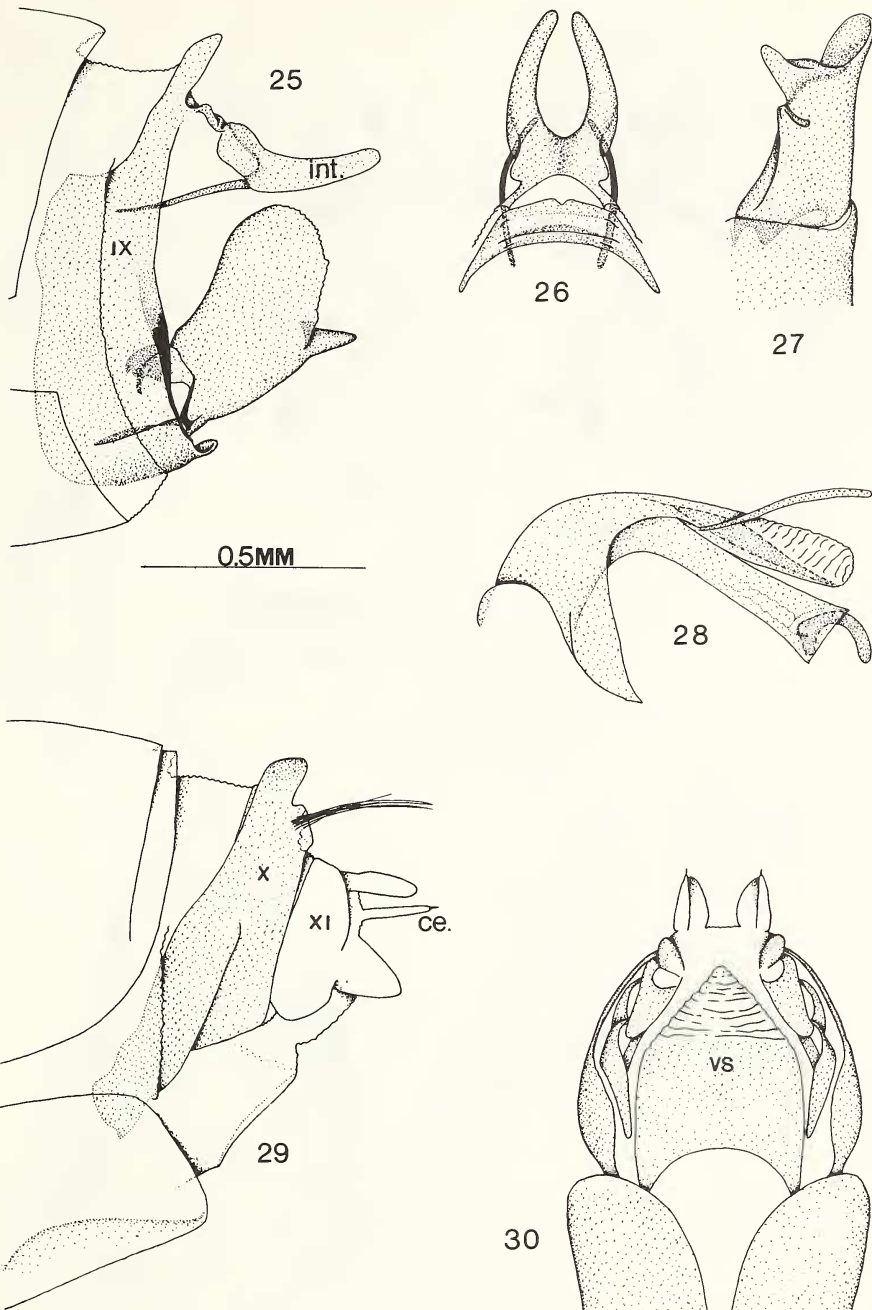


Fig. 25–30, *Parapsyche almota* Ross: 25, genital capsule of male, lateral aspect; 26, genital capsule of male, dorsal aspect; 27, right clasper of male, ventral aspect; 28, aedeagus of male, lateral aspect; 29, genital segments of female, lateral aspect; 30, genital segments of female, ventral aspect. int, intermediate appendage; ce, cercus; vs, vulval scale.

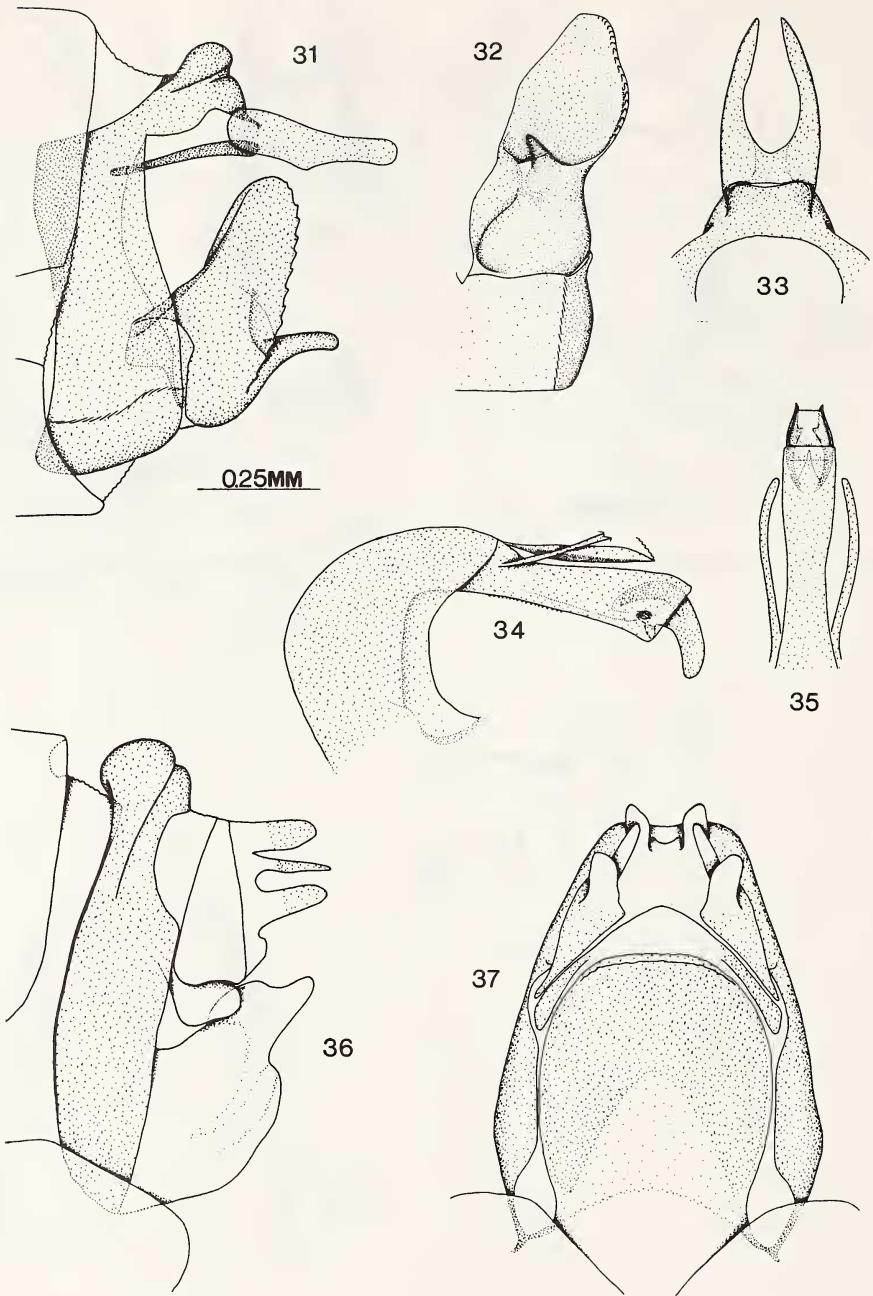


Fig. 31-37, *Parapsyche apicalis* (Banks): 31, genital capsule of male, lateral aspect; 32, right clasper of male, ventral aspect; 33, genital capsule of male, dorsal aspect; 34, aedeagus of male, lateral aspect; 35, aedeagus of male, distal half, ventral aspect; 36, genital segments of female, lateral aspect; 37, genital segments of female, ventral aspect.

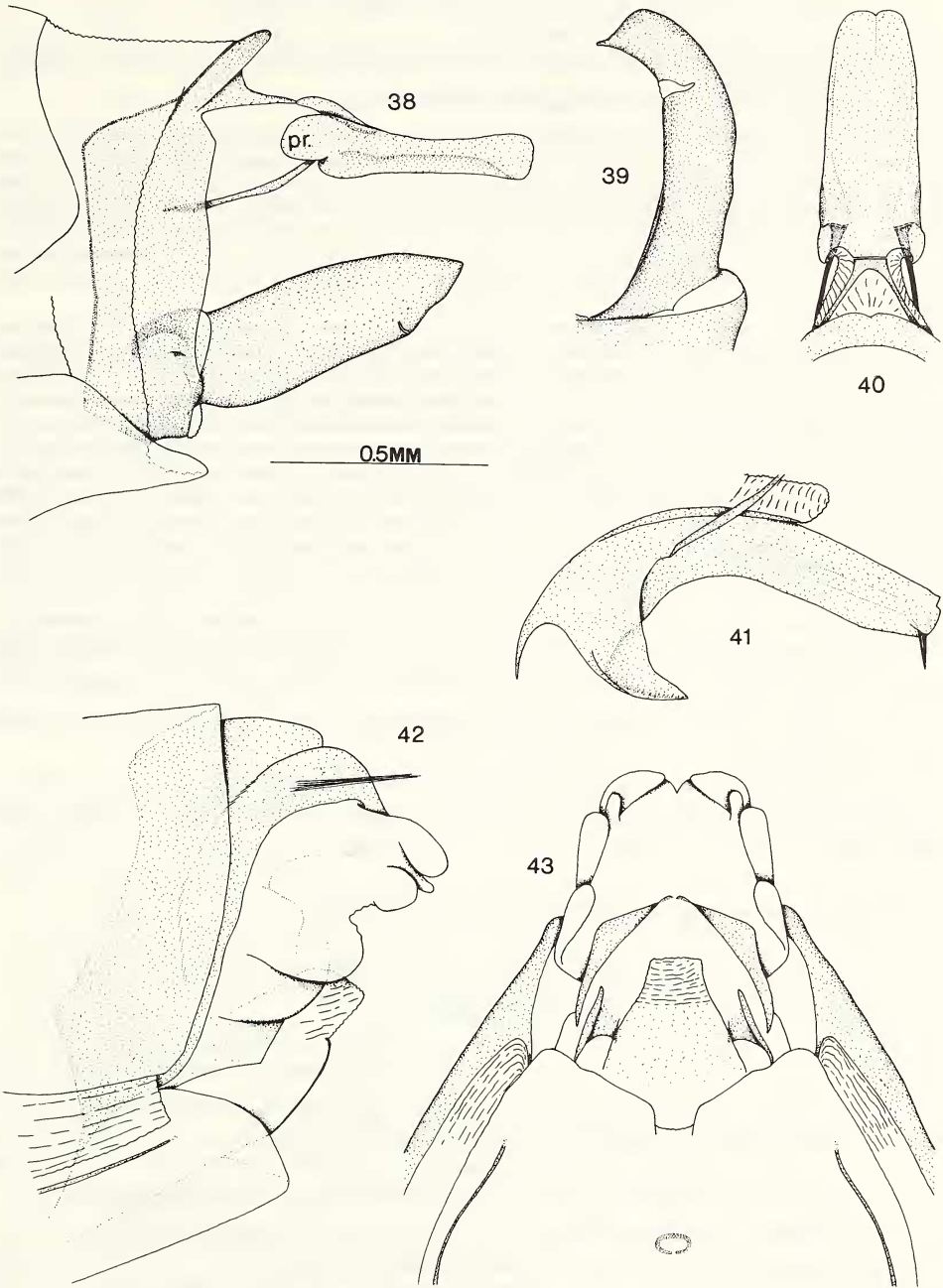


Fig. 38–43, *Parapsyche elsis* Milne: 38, genital capsule of male, lateral aspect; 39, right clasper of male, ventral aspect; 40, genital capsule of male, dorsal aspect; 41, aedeagus of male, lateral aspect; 42, genital segments of female, lateral aspect; 43, genital segments of female, ventral aspect. pr, preanal appendage.

## THE FAMILY HYDROPSYCHIDAE CURTIS

Hydropsychidae Curtis, 1835:Pl. 544 (& text); Betten, 1934:116, 123, 176; Milne, 1936:63, 67; Ross, 1944:76; Wiggins, 1977:92; Schmid, 1980:55.

Hydropsychinae; (Subfamily of Phryganeidae) Burmeister, 1839:907.

**Description.**— Ocelli absent. Eyes very large in males of some species. Maxillary palpi with five articles in both sexes; basal article variable in length; fifth article very long, flagellate. Tibia and tarsus of female middle legs enlarged, flattened in many taxa. Spur formula generally 2,4,4. Sternite V in many taxa with lobe with aperture of internal gland. Fore- and hind-wings different in shape. Fore-wing smoothly, slightly broadened distally, with truncate apex (Fig. 3a). Hind-wing larger, more rounded (Fig. 3b). Venation complete, with five marginal forks (fI-fV) generally present in fore-wing, and fI-fIII and fV present in hind-wing. Discoidal and median cells closed in fore-wing; thyridial cell very long. In hind-wing Sc in contact with R1; discoidal and median cells open or closed; four free anal veins extended to wing margin.

**Genitalia.** Male. (Fig. 44–47, 469–472, 483–487). Quite similar in all genera. Segment IX in most taxa, short, well developed dorsally (Fig. 44, 469, 483). Segment X bulky, located roof-like over aedeagus, with various specifically characteristic lobes. Preanal appendages present; entirely integrated with segment X; reduced, simple tubercles, each with tuft of short hairs. Intermediate appendages absent. Claspers (inferior appendages) directed postero-dorsad; of two simple, slender articles; curved mesad (Fig. 45) and, as pair, pincer-like. Aedeagus large, with greatly expanded base (Fig. 46); entirely, or almost entirely, composed only of the phallosome. Endotheca absent or minute; simple or complex.

**Genitalia.** Female. (Fig. 48–49, 473–474, 488–489). As in males, females are equally similar in all genera. Sternite VIII more or less divided to two large lobes by postero-ventral fissure. Segment X large, roughly triangular in lateral aspect (Fig. 49); produced deeply ventrad. Dorsal extremity of segment X with two tufts of stout hairs (omitted from illustrations here). Segment XI basically high, oblique rectangle, clothed in short hairs; with two small, tube-like, papillate lobes with cerci between, latter in many taxa with vestiges of distal article. Vulval scale large, elongate, largely membranous, basally articulated with ventral extremity of segment X.

Hydropsychid larvae are filter-feeders, building a sheltered retreat with attached net projected into the current, which is typical. Macronematine larvae are more specialised in their structures, and frequent warmer, less turbulent waters. Very few species are recorded west of the Great Plains of North America, in the Cordillera. Larvae of some species live along wave-swept lake shores.

While retaining a basic uniformity throughout, the Hydropsychidae are represented by a multitude of species on every continent but Antarctica. In Canada are found six genera. The species known, or likely to be recorded from Canada number 72.

## Key to known or potential genera of Hydropsychidae of Canada

- |         |  |  |
|---------|--|--|
| 1a      | Discoidal and median cells of fore-wing small. Discoidal cell of hind-wing open. Fore-wing brown, barred with yellow . . . . .                       |  |
|         |  | Macronematinae Ulmer p. 173              |
|         |  | <i>Macrostemum</i> Kolenati, p. 173      |
| 1b      | Sternite V with long filament. Hind-wings large, rounded, with Sc and R1 markedly bowed distally (Fig. 4b). Antennae slightly crenate . . . . .      |  |
|         |  | Diplectroninae Ulmer, p. 167 . . . . . 2 |
| 1c      | Sternite V at most with lobe or faint prominence. Hind-wing constricted somewhat distally (Fig. 3b, 5b, 6b). Antennae slender, cylindrical . . . . . |  |
|         |  | Hydropsychinae Curtis, p. 23 . . . . . 3 |
| 2a (1b) | Hind-wing apex rounded; with Sc and R1 bowed deeply apically (Fig. 4b) . . . . .   |  |
|         |  | <i>Diplectrona modesta</i> Banks, p. 170 |
| 2b      | Hind-wing apex more bluntly rounded (Fig. 1b); with Sc and R1 not bowed deeply apically . . . . .  |  |
|         |  | <i>Aphropsyche doringa</i> Milne, p. 167 |
| 3a (1c) | Stems of M and Cu1 of hind-wing parallel, very close together (Fig. 5b, 6b); fI present . . . . .  |  |
|         |  | . . . . . 4                              |

- 3b           Stems of hind-wing M and Cu1 not parallel, not close; fl absent (Fig. 3b) . . . . . *Cheumatopsyche* Wallengren, p. 23
- 4a (3a)     In fore-wing, cross-veins M3+4-Cu1 and Cu1-Cu2 close (Fig. 6a); A in contact with Cu2 prior to wing margin. Hind-wing median cell open (Fig. 6b) . . . . . *Potamyia flava* (Hagen), p. 164
- 4b           In fore-wing, cross-veins M3+4-Cu1 and Cu1-Cu2 clearly separated (Fig. 5a); A terminated at wing margin. Hind-wing median cell closed (Fig. 5b) . . . . . *Hydropsyche* Pictet, p. 76

### The Subfamily Hydropsychinae Curtis

Hydropsychinae Curtis, 1835: pl. 544 (text); Betten, 1934:118, 177; Milne, 1936:67; Ross & Unzicker, 1977:298; Wiggins, 1977:93; Schmid, 1979:48; Schmid, 1980:48.

*Description*.— Antennae slender, slightly longer than fore-wings, especially in male. Maxillary palpi with first and second articles equal; third and fourth articles short. Vertex with more than two warts. Tibia and tarsus of female middle legs flattened, enlarged. Fore-wing slightly, evenly widened distad (Fig. 3a, 5a, 6a); distally truncate. Hind-wing (Fig. 3b, 5b, 6b) slightly larger than fore-wing; with evenly rounded anal edge, but distally constricted. Venation complete; fl-fv present in fore-wing, fl-fIII and fv in hind-wing. Discoidal and median cells rather small; fl and fIII petiolate. Hind-wing discoidal cell closed; median cell open (Fig. 6b) or closed (Fig. 5b).

*Genitalia*. Male. (Fig. 44–47, 182–186, 463–466). Segment IX rather short; with postero-lateral edge more or less projected posterad. Segment X either simple, or bilobed with distal lobes or processes. Claspers (inferior appendages) slender, of two articles. Aedeagus simple or with complex apex.

*Genitalia*. Female. (Fig. 48–49, 187–188, 467–468). Segment X with only narrow ventro-lateral extremity which serves to support vulval scale. Dorsal-lateral face of segment X with more or less evident clasper receptacle, or apparently absent.

### Genus *Cheumatopsyche* Wallengren

Maps 7–30; Fig. 3, 44–181

*Cheumatopsyche* Wallengren, 1891:138, 142; Denning, 1943:138; Ross, 1944:108; Gordon, 1974:117; Wiggins, 1977:100; Schmid, 1980:60.

*Ulmeria* Navás, 1918:15; Navás, 1933:98.

*Hydropsychodes* Ulmer, 1905:34; Kimmins, 1963:130.

*Description*.— Small, slender insects. Tarsal claws variously deformed or normal. Cross-veins M3+4-Cu1 and Cu1-Cu2 of fore-wings adjacent (Fig. 3a). Hind-wing fl absent; median cell open; stems of M and Cu1 divergent, not very close (Fig. 3b).

*Genitalia*. Male. (Fig. 44–47, etc.). Very similar to *Hydropsyche* species. Segment IX postero-lateral angle generally less prominent, more ventrad (Fig. 44, 50). Segment X less bulky; terminated in two or four setose, specifically distinct lateral lobes (Fig. 47, 53), separated by inconspicuous median bridge. Claspers (inferior appendages) slender, with distal article of many species curved mesad, claw-like (Fig. 45). Aedeagus proximally very large; simple; distally terminated by two large endothecal valves.

*Genitalia*. Female. (Fig. 48–49, etc.). Tergite VIII with posterior edge not notched. Sternite VIII divided longitudinally to two halves or lobes. Segment X without postero-lateral margin produced posterad. Clasper receptacle or not; the term "chimney" is used here to refer to the 'apical two-thirds' of clasper receptacle (Jordan, 1974).

Wiggins (1977), partly quoting from earlier authors, wrote us that *Cheumatopsyche* larvae tend to be more dominant in warmer streams than *Hydropsyche* larvae, and to be more pollution tolerant than most other species of caddisflies. Larvae of this genus have also been found as deep as 20 cm in stream-bed gravels. Gut-content analysis indicates that feeding is largely on algae and small animals, with little detrital component.

*Cheumatopsyche* is represented in all regions but the Neotropical and the Antarctic continent. Gordon (1974) identifies 39 species known from the Nearctic region. In this work I deal with 24 species known from Canada, or potentially to be found here.

**Key to known or potential species of *Cheumatopsyche* of Canada (Adapted from Gordon, 1974)**

1a	Males .....	2	
1b	Females .....	25	
2a	(1a) Distal article of clasper not produced to tapered apex in lateral aspect (Fig. 50); short, blunt .....	<i>sordida</i> complex, p. 27 .....	3
2b	Distal article of clasper long, tapered (Fig. 135) .....	<i>gracilis</i> complex, p. 32 .....	4
3a	(2a) Aedeagus base very large (Fig. 46). Lobes of tergum X, acuminate hooks directed dorsad (Fig. 44). Tergum X with long, sclerotised, distally bulbous, median process emergent posteriorly from below tergum (Fig. 44, 47) .....	<i>C. minuscula</i> (Banks), p. 27 .....	
3b	Aedeagus base moderately large at most (Fig. 52). Lobes of tergum X wide in lateral aspect (Fig. 50). Median process absent .....	<i>C. sordida</i> (Hagen), p. 28 .....	
4a	(2b) Dorsum of tergite X domed (Fig. 99) .....	<i>C. wabasha</i> Denning, p. 46 .....	
4b	Dorsum of tergite X flat (Fig. 142) .....		5
5a	(4b) Dorsal lobes of segment IX indistinctly defined, with single seta (Fig. 130). Aedeagus elongate, almost linear .....	<i>C. vannotei</i> Gordon, p. 60 .....	
5b	Dorsal lobes of segment IX clearly defined, with numerous setae (Fig. 163). Aedeagus not elongate, not linear .....		6
6a	(5b) Preanal appendages vertically long, linear in lateral aspect (Fig. 163) .....	<i>C. mollala</i> Ross, p. 65 .....	
6b	Preanal appendages vertically short, circular in lateral aspect (Fig. 63) .....		7
7a	(6b) Distal lobes of tergum X with apices elongate, reflexed (Fig. 59, 66, 72) .....		8
7b	Distal lobes of tergum X with apices not reflexed (Fig. 148) .....		10
8a	(7a) Distal article of clasper, in posterior aspect, short (Fig. 64); not fully curved; distal portion straight or possibly slightly recurved. Lobes of tergum X broad, rounded in lateral aspect (Fig. 63); anterad of turned-up distal edges of tergum; lobes not visible in posterior aspect .....	<i>C. pinaca</i> Ross, p. 32 .....	
8b	Distal article of clasper, in posterior aspect (Fig. 57, 70), longer; entire article almost straight. Distal lobes of tergum X with apices visible in posterior aspect (Fig. 59, 72); distal edge of tergum turned dorsad (Fig. 59), or not (Fig. 72) .....		9
9a	(8b) Distal article of clasper, in lateral aspect (Fig. 56) hooked sharply dorsad at tip. Distal edge of tergum X produced posterad of distal lobes, flared dorsad .....	<i>C. speciosa</i> (Banks), p. 32 .....	
9b	Distal article with only slightly curved tip (Fig. 69). Distal edge of tergum X not produced posterad of distal lobes, not flared dorsad .....	<i>C. lasia</i> Ross, p. 32 .....	
10a	(7b) Distal article of clasper two-thirds length of basal article (Fig. 145, 146) .....	<i>C. oxa</i> Ross, p. 64 .....	
10b	Distal article, at most, only half length of basal article (Fig. 107, 113, 129) .....		11
11a	(10b) Distal lobes of tergum X circular or ovate dorsally, in posterior aspect (Fig. 110, 116, 131) .....		12
11b	Distal lobes of tergum X not circular or ovate dorsally, in posterior aspect .....		



	(Fig. 141, 153, 179) . . . . .	14
12a (11a)	Distal lobes of tergum X widely separated from main body of tergum, in lateral aspect . . . . . <i>C. pettiti</i> (Banks), p. 48	
12b	Distal lobes with only short gap between them and main body of tergum X (Fig. 107, 129) . . . . .	13
13a (12b)	Distal article of clasper, in posterior aspect, clearly recurved (Fig. 108) . . . . . <i>C. smithi</i> Gordon, p. 48.	
13b	Distal article curved dorsad only (Fig. 130) . . . . . <i>C. h. harwoodi</i> Denning, p. 54	
14a (11b)	Basal article of clasper strongly curved mesad in posterior aspect (Fig. 177). Mesal face of distal article concave . . . . . <i>C. enonis</i> Ross, p. 66	
14b	If clasper curved mesad than mesal face of distal article not concave (Fig. 127) . . . . .	15
15a (14b)	Distal lobes of tergum X directed antero-laterad (Fig. 125) in lateral aspect, appressed against side of tergum . . . . . <i>C. wrighti</i> Ross, p. 54	
15b	Distal lobes of tergum X not as above (Fig. 151) . . . . .	16
16a (15b)	Distal lobes of tergum X wide, rectangular in lateral aspect (Fig. 151) . . . . . <i>C. aphantia</i> Ross, p. 64	
16b	Distal lobes of tergum X narrow, or not rectangular (Fig. 129) . . . . .	17
17a (16b)	Distal lobes of tergum X subquadrate, with lateral processes near venter (Fig. 84) . . . . . <i>C. mickeli</i> Denning, p. 38	
17b	Distal lobes of tergum X not as above . . . . .	18
18a (17b)	Distal lobes of tergum X oval or lanceolate (Fig. 78, 172) . . . . .	19
18b	Distal lobes of tergum X either square, clavate, or shouldered (Fig. 87, 93, 119) . . . . .	20
19a (18a)	Distal lobes of tergum X without gap between them and main body of tergum X (Fig. 169); dorsal tips clearly separated (Fig. 172) . . . . . <i>C. burksi</i> Ross, p. 65	
19b	Distal lobes of tergum X inclined posterad away from main body of tergum X (Fig. 75); dorsal tips close to each other (Fig. 78) . . . . . <i>C. pasella</i> Ross, p. 38	
20a (18b)	Clasper markedly curved; distal article with broad base in posterior aspect (Fig. 136, 158) . . . . .	21
20b	Clasper not markedly curved, or distal article narrow, sinuate (Fig. 88, 94, 105, 121) . . . . .	22
21a (20a)	Distal lobes of tergum X high, narrow, finger-like in lateral aspect (Fig. 157) . . . . . <i>C. halima</i> Denning, p. 65	
21b	Distal lobes of segment X short, wide, with distinctly angled antero-dorsal edge in lateral aspect (Fig. 135) . . . . . <i>C. gracilis</i> (Banks), p. 60	
22a (20b)	Distal lobes of tergum X, in posterior aspect (Fig. 120), short, clearly separated, with distinct lateral angle . . . . . <i>C. helma</i> Ross, p. 54	
22b	Distal lobes of tergum X, in posterior aspect (Fig. 90, 95, 104), close, with dorsal prolongations . . . . .	23
23a (22b)	Segment IX with distinct angular development of postero-lateral margin . . . . . <i>C. ela</i> Denning, p. 39	
23b	Postero-lateral margin of segment IX not angled (Fig. 87, 103) . . . . .	24
24a (23b)	Dorso-lateral lobes of segment IX well developed (Fig. 87) . . . . .	

		<i>C. campyla</i> Ross, p. 38	
24b	Dorso-lateral lobes of segment IX barely evident (Fig. 103)		
		<i>C. logani</i> Gordon, p. 48	
25a (1b)	Clasper receptacle absent, or not visible, or minute in lateral aspect (Fig. 49, 55)	<i>sordida</i> complex, p. 27	26
25b	Clasper receptacle clearly visible in lateral aspect (Fig. 60, 68, 156)	<i>gracilis</i> complex, p. 32	27
26a (25a)	Clasper receptacle, in lateral aspect (Fig. 49), a minute circle high up on segment X	<i>C. minuscula</i> (Banks), p. 27	
26b	Clasper receptacle, in lateral aspect (Fig. 55), very small, triangular invagination high up on segment X on border between darker anterior bulk of segment, and paler posterior area	<i>C. sordida</i> (Hagen), p. 28	
27a (25b)	Clasper receptacle short, small, located high on segment X (Fig. 86, 174, 181)		28
27b	Clasper receptacle longer, larger, in most specimens located at a level ventrad of ventral lobe of segment XI (Fig. 97, 112, 118, etc.)		30
28a (27a)	Inner end of clasper receptacle, in lateral aspect, apparently not open, rounded (Fig. 174, 181)		29
28b	Inner end of clasper receptacle, in lateral aspect, clearly open (Fig. 86)	<i>C. mickeli</i> Denning, p. ...	
29a (28a)	Inner end of clasper receptacle, in lateral aspect, directed anterad (Fig. 181). Vulval scale without sclerotised band	<i>C. enonis</i> Ross, p. 66	
29b	Inner end of clasper receptacle, in lateral aspect, directed dorsad (Fig. 174). Vulval scale with very narrow sclerotised strap, proximal end abruptly flared	<i>C. burksi</i> Ross, p. 65	
30a (27b)	Clasper receptacle outer edge without of marginal incision (Fig. 60, 68, 118, 140, 156, 162, 168)		31
30b	Clasper receptacle outer edge with incision, either rounded or angular (Fig. 74, 80, 92, 97, 112, 124, 134, 150)		37
31a (30a)	Posterior margin of segment X overlapped by marginal flange developed from outer edge of clasper receptacle		32
31b	No such flange or overlap (Fig. 60, 68, 118, 140, 168)		33
32a (31a)	Development of flange dorsad, along posterior edge of segment X; clasper receptacle apparently with two chimneys (Fig. 156)	<i>C. aphantia</i> Ross, p. 64	
32b	No such development of flange (Fig. 162)	<i>C. halima</i> Denning, p. 65	
33a (31b)	Anterior end of outer margin of clasper receptacle continued on lateral face of segment X as thin, black line; length various with species (Fig. 60, 118, 140)		34
33b	No such continuation of outer margin (Fig. 68, 168)		36
34a (33a)	Clasper receptacle tubular (Fig. 60)	<i>C. speciosa</i> (Banks), p. 32	
34b	Clasper receptacle papillate (Fig. 118, 140)		35
35a (34b)	Clasper receptacle long, located dorsally (Fig. 140)	<i>C. gracilis</i> (Banks), p. 60	
35b	Clasper receptacle small, located at level ventrad of ventral lobe of segment XI (Fig. 118)	<i>C. pettiti</i> (Banks), p. 48	
36a (33b)	Posterior edge of each half of sternite VIII with small, rounded process close to lateral corner (Fig. 68)	<i>C. pinaca</i> Ross, p. 32	

36b	No such process present . . . . .	<i>C. mollala</i> Ross, p. 65	
37a (30b)	Incision of outer margin of clasper receptacle angled (Fig. 80, 92, 97, 134) . . . . .		38
37b	Incision of outer margin of clasper receptacle rounded; large (Fig. 112, 150), through small (Fig. 74), to minute (Fig. 124) . . . . .		41
38a (37a)	Inner opening of clasper receptacle, in lateral aspect, visible (Fig. 80, 92) . . . . .		39
38b	Inner opening of clasper receptacle not visible in lateral aspect, rounded (Fig. 97, 134) . . . . .		40
39a (38a)	Incision of clasper receptacle margin directed anterad (Fig. 80) . . . . .	<i>C. pasella</i> Ross, p. 38	
39b	Incision of clasper receptacle margin directed dorsad (Fig. 92) . . . . .	<i>C. campyla</i> Ross, p. 38	
40a (38b)	Anterior end of clasper receptacle margin extended antero-ventrad across lateral face of segment X as fine, sinuate, dark line (Fig. 134) . . . . .	<i>C. h. harwoodi</i> Denning, p. 54	
40b	No such continuation of clasper receptacle margin (Fig. 97) . . . . .	<i>C. ela</i> Denning, p. 39	
41a (37b)	Inner opening of clasper receptacle visible in lateral aspect (Fig. 74, 150) . . . . .		42
41b	Inner opening of clasper receptacle not visible in lateral aspect (Fig. 112, 124) . . . . .		43
42a (41a)	Inner opening of clasper receptacle as wide as chimney (Fig. 150) . . . . .	<i>C. oxa</i> Ross, p. 64	
42b	Inner opening narrower than chimney (Fig. 74) . . . . .	<i>C. lasia</i> Ross, p. 32	
43a (41b)	Marginal incision of clasper receptacle margin narrow, minute; anterior end of margin associated with fine, dark, sinuate line just anterad (Fig. 124) . . . . .	<i>C. helma</i> Ross, p. 54	
43b	Marginal incision of clasper receptacle wide, of medium size; no fine, dark line associated with anterior end of margin (Fig. 112) . . . . .	<i>C. smithi</i> Gordon, p. 48	

Gordon (1974) divides this genus into *sordida* and *gracilis* complexes, which are included in the above key. These complexes are each further subdivided to species groups. Other than presenting the species included here in the order of complexes, species groups, and species used by Gordon, no further details are given regarding them. It is considered that the minutiae involved are beyond the scope of the present work.

#### THE *SORDIDA* COMPLEX THE *SORDIDA* GROUP

##### *Cheumatopsyche minuscula* (Banks) Map 7; Fig. 44–49

*Hydropsyche minuscula* Banks, 1907:130; Milne, 1936:73 (as synonym of *C. sordida*).

*Hydropsychodes minuscula*; Carpenter, 1933:43; Betten, 1934:195.

*Cheumatopsyche minuscula*; Ross, 1938c:15; Denning, 1943:142; Ross, 1944:110; Gordon, 1974:127.

*Cheumatopsyche montrealensis* Nimmo, 1966a:689; Gordon, 1974:127.

**Description.**— Male fore-wing length 7.72 mm; red-brown, without evident pattern. Hind-wing paler than fore-wing, but distinctly tinted. Antennae greyish brown; each flagellar annulus with oblique, faint, darker band around mid-point. Vertex dark red-brown; warts slightly paler, surrounded by very dark boundary. Spurs dark brown; lateral member of middle and hind-leg pairs slightly smaller than mesal companions. Thorax deep red-brown dorsally, to paler

laterally. Legs straw-coloured, with tarsal articles darker.

*Genitalia*. Male. (Fig. 44–47). (Specimen from Ile Ste Hélène, St Lawrence R., Montréal, Québec – Holotype of *C. montrealensis* Nimmo). Males distinguished by distal lobes of tergum X small, hooked dorsad in lateral aspect (Fig. 44); by blunt, rounded distal article of clasper in lateral aspect (Fig. 44); and by long, thin, distally bulbous process emergent from beneath tergum X (Fig. 44, 47).

*Genitalia*. Female. (Fig. 48–49). (Specimen from Ile Ste Hélène, St Lawrence R., Montréal, Québec). Females distinguished by minute, circular or elliptical clasper receptacle high on lateral face of segment X, in lateral aspect (Fig. 49).

*Biology*.— Available records indicate that larvae of this species prefer fair-sized to extremely large, turbulent, rubble-bottomed rivers. Flight dates range from June 6 to September 9, peaking in late June and July.

*Distribution*.— To date the species has been recorded from Manitoba and the lower St Lawrence River in the north, to Oklahoma and Georgia in the south (Map 7). In Canada it is now known from eastern Manitoba to the Saguenay River of Québec, but most records are from southern Québec and Ontario.

### *Cheumatopsyche sordida* (Hagen)

Map 8; Fig. 50–55

*Hydropsyche sordida* Hagen, 1861:290; Milne, 1936:70, 72, 73.

*Hydropsychodes sordida*; Ulmer, 1905b:100; Betten, 1934:196.

*Cheumatopsyche sordida*; Ross, 1938c:15; Denning, 1943:142; Ross, 1944:110; Gordon, 1974:126.

*Description*.— Male fore-wing length 6.86 mm; uniform rich dark brown. Hind-wing uniformly, palely tinted deep brown. Antennae deep brown; basal five flagellar annuli with oblique, darker bands. Female with six banded annuli. Vertex very dark brown. Spurs brown; lateral member of middle and hind-leg pairs notably shorter than mesal companions, in males; not so in females. Thorax very dark brown, to red-brown laterally. Legs yellow-brown.

*Genitalia*. Male. (Fig. 50–53). (Specimen from Ile Ste Hélène, St Lawrence R., Montréal, Québec). Males distinguished by short, blunt distal article of clasper, in lateral aspect (Fig. 50); by widely separated distal lobes of tergum X in posterior aspect (Fig. 53), with dorso-lateral angles toothed; and by distal portion of aedeagus phalotheca deeply keeled ventrally (Fig. 52).

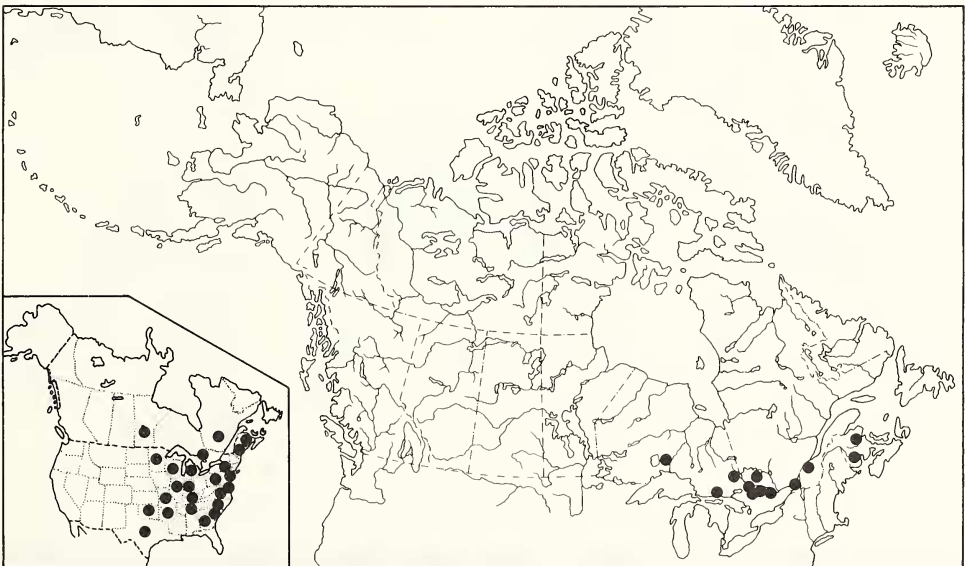
*Genitalia*. Female. (Specimen from Ile Ste Hélène, St Lawrence R., Montréal, Québec). Females differentiated by very small, triangular clasper receptacle, in lateral aspect (Fig. 55), located well dorsad on lateral face of segment X and with outer margin as part of boundaryline between anterior darker part of segment, and posterior lighter part.

*Biology*.— Available records indicate that larvae of this species inhabit a wide variety of flowing waters in Canada, ranging from small to very large rivers, and from slow-flowing boreal waters to fast, turbulent rivers. Flight dates range from June 7 to August 14, with possible peak about end of June, early July.

*Distribution*.— Recorded from Manitoba to New Brunswick in the north, to Texas and Georgia in the south (Map 8). In Canada it is recorded from Lake Winnipeg to southern New Brunswick, with most records being from the Ottawa River drainage.



Map 7. Collection localities for *Cheumatopsyche minuscula* (Banks) in Canada, with known distribution in North America by state or province.



Map 8. Collection localities for *Cheumatopsyche sordida* (Hagen) in Canada, with known distribution in North America by state or province.

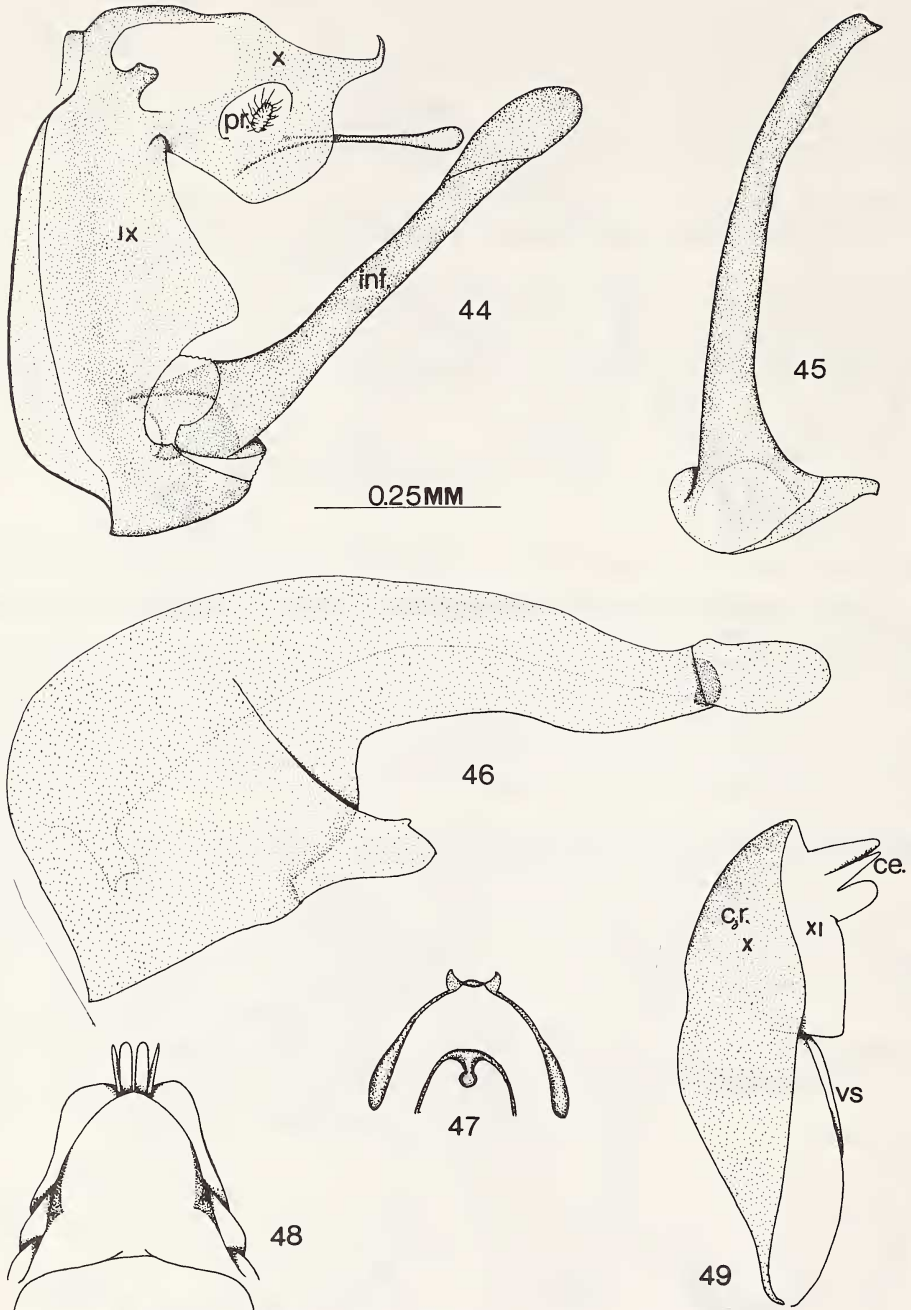


Fig. 44-49, *Cheumatopsyche minuscula* (Banks): 44, genital capsule of male, lateral aspect; 45, left clasper of male, posterior aspect; 46, aedeagus of male, lateral aspect; 47, segment X of male, posterior aspect; 48, genital segments of female, dorsal aspect; 49, genital segments of female, lateral aspect. inf, inferior appendage (clasper); pr, preanal appendage; cr, clasper receptacle; vs, vulval scale.

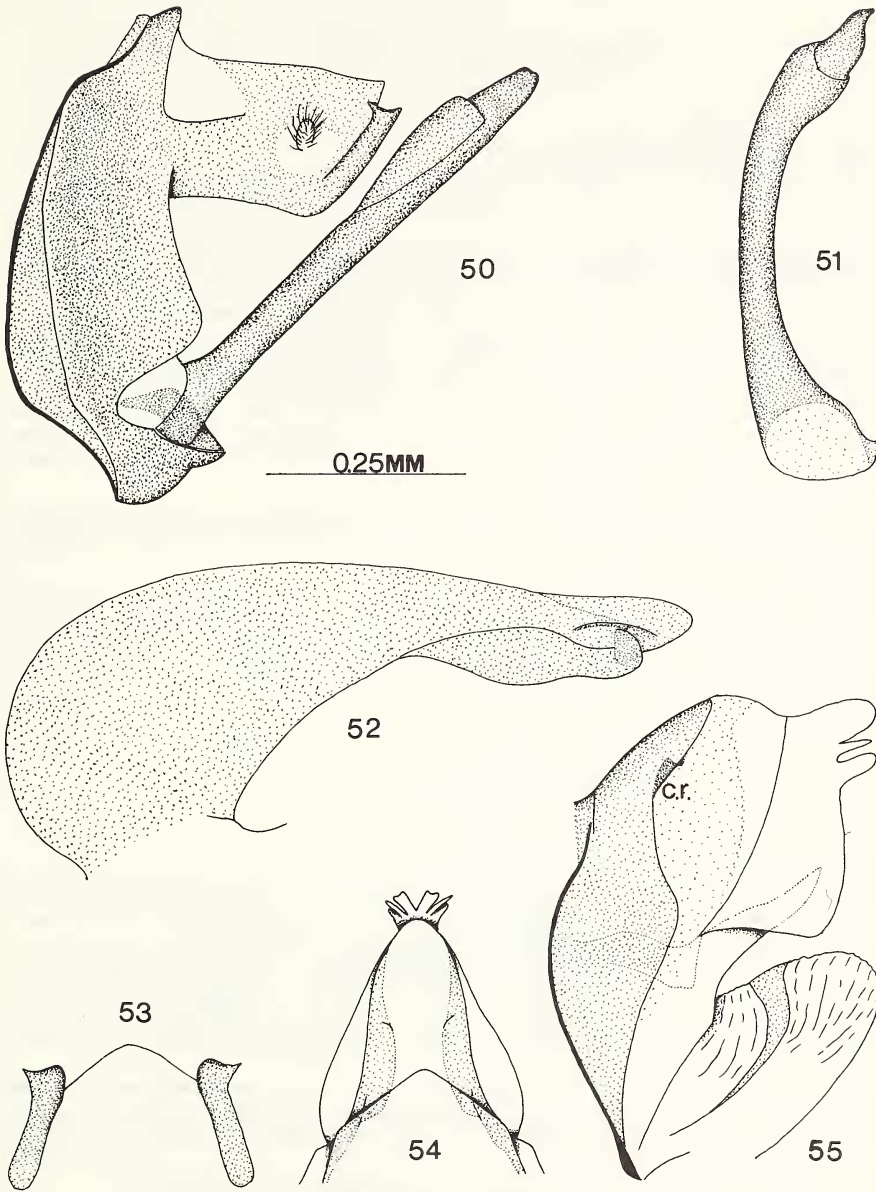


Fig. 50-55, *Cheumatopsyche sordida* (Hagen): 50, genital capsule of male, lateral aspect; 51, left clasper of male, posterior aspect; 52, aedeagus of male, lateral aspect; 53, segment X of male, posterior aspect; 54, genital segments of female, dorsal aspect; 55, genital segments of female, lateral aspect. cr, clasper receptacle.

THE *GRACILIS* COMPLEX  
THE *SPECIOSA* GROUP

*Cheumatopsyche speciosa* (Banks)

Map 9; Fig. 56–62

*Hydropsyche speciosa* Banks, 1904a:214; Milne, 1936:71, 73.

*Hydropsychodes speciosa*; Neave, 1929:190; Betten, 1934:197.

*Cheumatopsyche speciosa*; Ross, 1938c:15; Denning, 1943:154; Ross, 1944:114; Gordon, 1974:134.

**Description.**— Male fore-wing length 5.54 mm; grey-brown with scattered irroration and larger areas of hyaline membrane which give transverse banded appearance. Antennae yellowish brown; basal five flagellar annuli each with slightly darker, oblique band (not evident in female). Vertex reddish brown. Spurs yellow; members of each pair essentially equal. Thorax deep reddish brown, to yellowish brown laterally. Legs straw-coloured.

**Genitalia.** Male. (Fig. 56–59). (Specimen from Whitemud Ck, Ellerslie, Alberta). Males distinguished by deep cleft between dorsum of segment IX and tergum X, in lateral aspect (Fig. 56); by distal lobes of segment X adjacent to this cleft, and posterior extremity of tergum X flared dorso-laterad as pair of flanges (Fig. 56, 59); and by long, slender distal article of clasper, more or less linear in posterior aspect (Fig. 57), sinuate, hooked dorsad in lateral aspect (Fig. 56).

**Genitalia.** Female. (Fig. 60–62). (Specimen from Whitemud Ck, Ellerslie, Alberta). Females distinguished by postero-lateral angle of each half of sternite VIII (Fig. 62) with small, triangular process; by inner opening of clasper receptacle not visible in lateral aspect (Fig. 60), receptacle of more or less uniform width; and by outer margin of clasper receptacle with anterior extremity higher than posterior extremity.

**Biology.**— This species is recorded from small, sluggish streams, and the largest, turbulent, rubble-bottomed rivers. Flight dates range from July 6 to August 29, with a diffuse peak in late June and July.

**Distribution.**— Recorded from Alberta to Labrador in the north, to Oklahoma and South Carolina in the south (Map 9). Canadian records are thinly scattered from east of the Rocky Mountain Foothills in Alberta, to northern Québec and Labrador in the east, and south to the United States border.

*Cheumatopsyche pinaca* Ross

Map 10; Fig. 63–68

*Cheumatopsyche pinaca* Ross, 1941:82; Ross, 1944:294; Gordon, 1974:133.

**Description.**— Male fore-wing length 5.75 mm; pale brown; faintly irrorate. Antennae orange-brown; basal five flagellar annuli each with oblique, darker band. Vertex dark brown; warts paler. Spurs brownish yellow; lateral member of middle leg pairs notably shorter than mesal companions. Thorax orange-brown. Legs straw-coloured.

**Genitalia.** Male. (Fig. 63–66). (Specimen from southern Appalachians, USA). Males distinguished by distal lobes of tergum X, in lateral aspect, short, rounded (Fig. 63); by extreme distal edge of tergum X flared dorso-laterad as pair of triangular flanges [distal lobes not visible in posterior aspect (Fig. 66)]; by distal article of clasper short, sharply but smoothly tapered distad, hooked dorsad in lateral aspect (Fig. 63); and by distal end of aedeagus slightly keeled ventrally (Fig. 65).

**Genitalia.** Female. (Fig. 67–68). (Specimen from southern Appalachians, USA). Females differentiated by lateral corner of each half of sternite VIII with short, rounded process (Fig. 68); by sclerotised band of vulval scale very wide, saddle-like across dorsum of scale; by clasper receptacle, in lateral aspect, papillate; and by anterior end of clasper receptacle outer margin much higher than posterior end.

**Biology.**— Neves (1979) records flight period in Massachusetts as June to August.

**Distribution.**— This species, not yet recorded from Canada, is recorded from Maine to Florida in the United States, west to Tennessee (Map 10).

*Cheumatopsyche lasia* Ross

Map 11; Fig. 69–74

*Cheumatopsyche lasia* Ross, 1938b:154; Denning, 1943:153; Ross, 1944:114; Gordon, 1974:132.



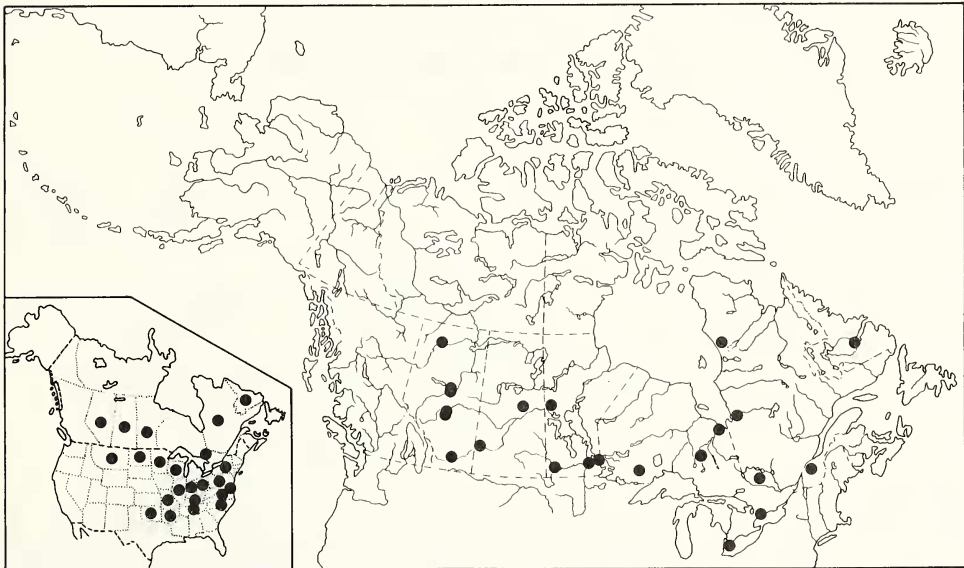
**Description.**— Male fore-wing length 4.3 mm; uniform golden brown. Hind-wing palely tinted golden brown. Antennae yellow-brown; with at least basal six flagellar annuli each with oblique, darker band. Vertex deep red-brown; warts rather paler. Spurs yellow; lateral member of mid-leg pairs notably shorter than mesal companions. Thorax very deep red-brown, to paler grey-brown laterally. Legs yellow-brown.

**Genitalia.** Male. (Fig. 69–72). (Specimen from Red Deer R., Drumheller, Alberta). Males distinguished by segment IX with distinct dorsal lobes (Fig. 69); by distal lobes of Tergum X projected well dorsad of main body of tergum X, in lateral aspect; and by these distal lobes with distinct basal processes, best seen in posterior aspect (Fig. 72).

**Genitalia.** Female. (Fig. 73–74). (Specimen from Brazos R., Palo Alto Co., Texas, USA). Females distinguished by clasper receptacle slightly expanded distally (Fig. 74); by inner opening visible in lateral aspect, narrower than chimney of receptacle, directed postero-dorsad; by outer margin of receptacle incised, incision small, rounded, directed antero-dorsad; by anterior end of receptacle outer margin higher at anterior end than posterior end; and by sclerotised strap of vulval scale broad, saddle-like across dorsal area of scale.

**Biology.**— Ross (1944) records the Illinois flight period as May to August, peaking in July and August. Available records from western Canada are for mid-July. It appears that adults emerge from the slower, less turbulent creeks and large rivers.

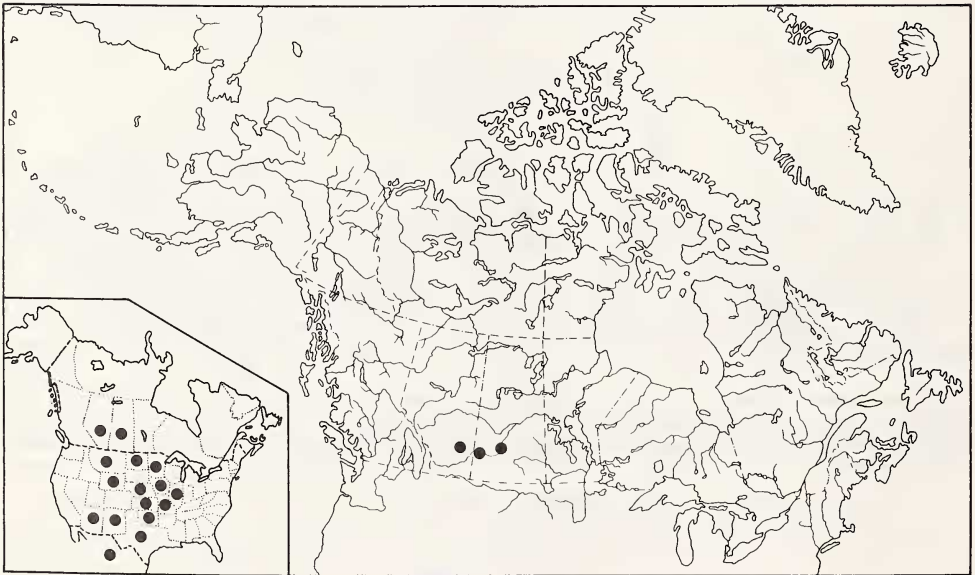
**Distribution.**— Recorded from México north to Alberta and Saskatchewan in Canada, and east to Illinois (Map 11). In western Canada it is recorded only from the South Saskatchewan River drainage.



Map 9. Collection localities for *Cheumatopsyche speciosa* (Banks) in Canada, with known distribution in North America by state or province.



Map 10. Known distribution of *Cheumatopsyche pinaca* Ross in North America, by state.



Map 11. Collection localities for *Cheumatopsyche lasia* Ross in Canada, with known distribution in North America by state or province.

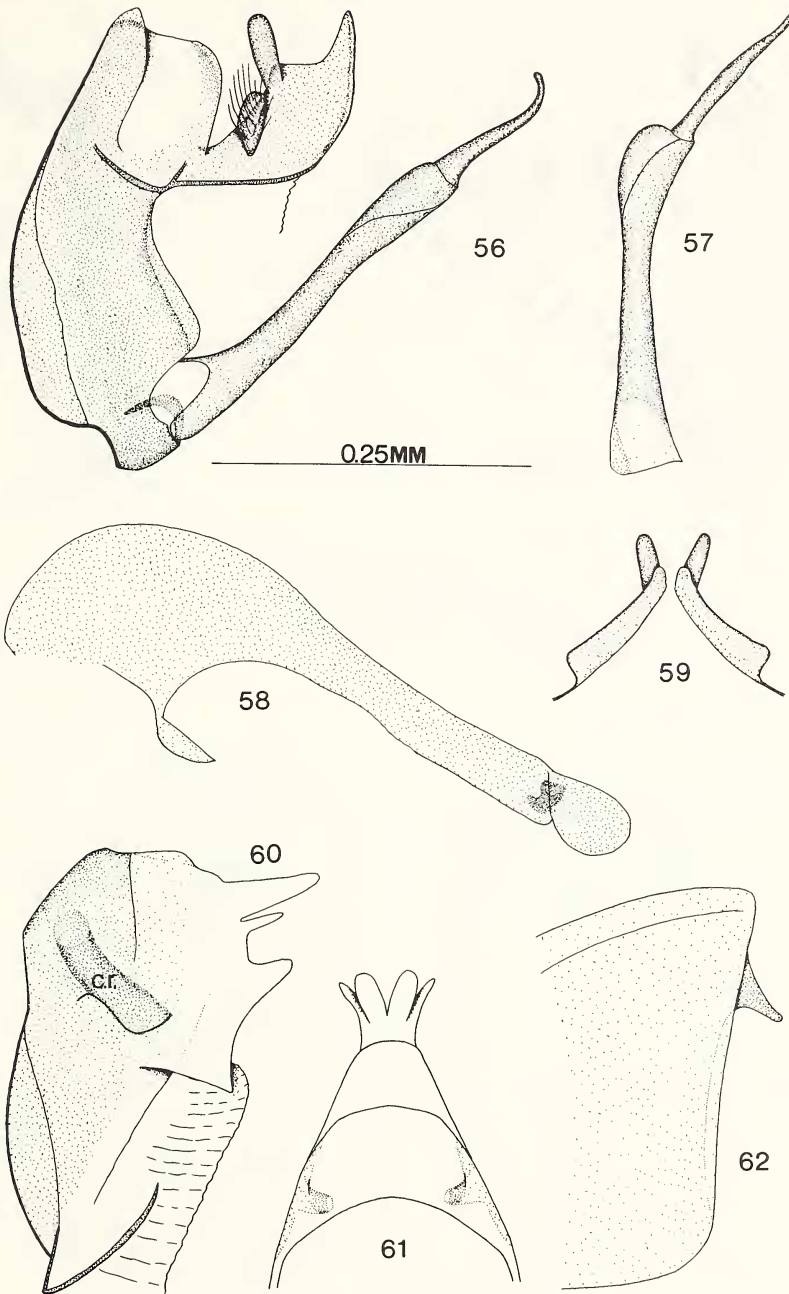


Fig. 56–62, *Cheumatopsyche speciosa* (Banks): 56, genital capsule of male, lateral aspect; 57, left clasper of male, posterior aspect; 58, aedeagus of male, lateral aspect; 59, segment X of male, posterior aspect; 60, genital segments of female, lateral aspect; 61, genital segments of female, dorsal aspect; 62, left half of sternite VIII of female, lateral aspect. cr, clasper receptacle.

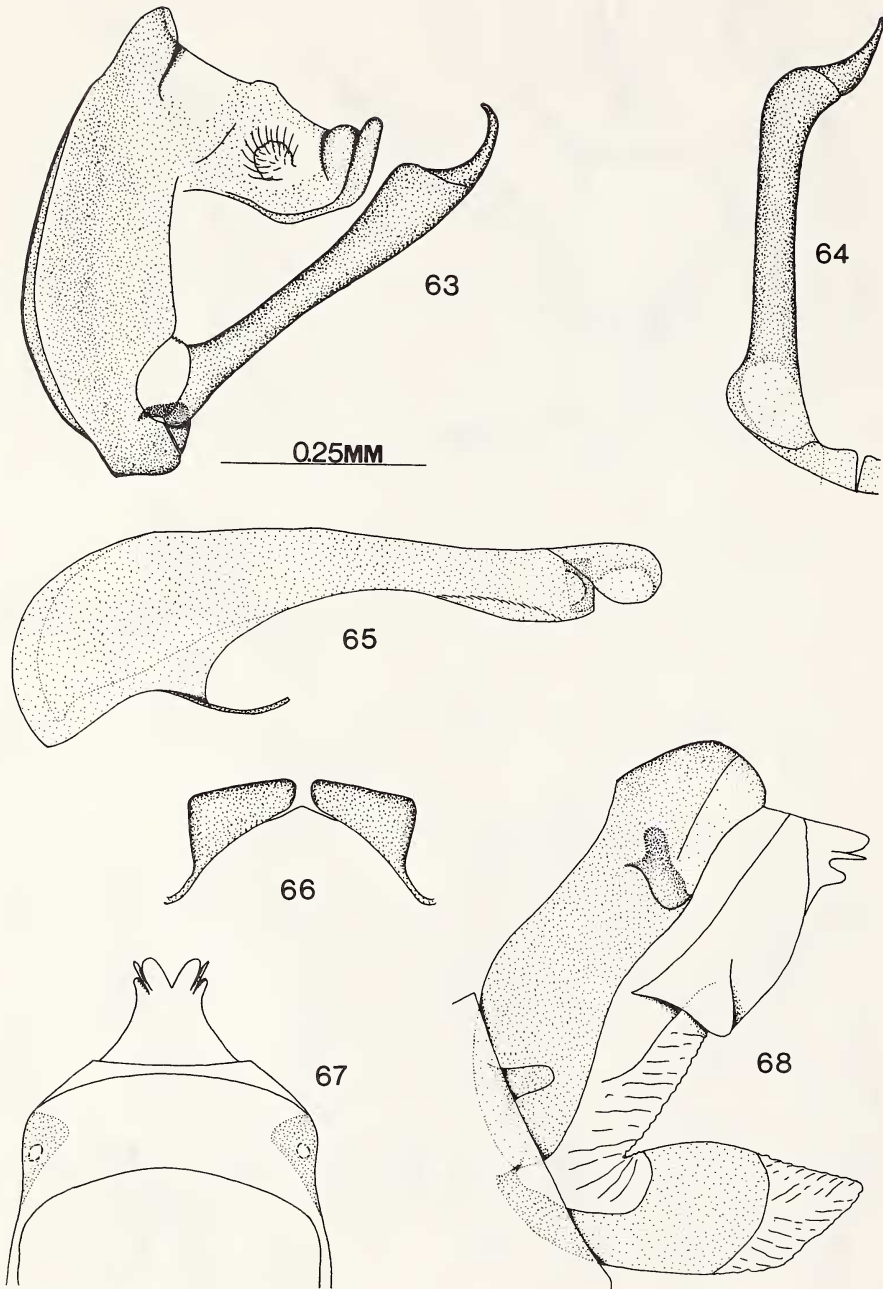


Fig. 63–68, *Cheumatopsyche pinaca* Ross: 63, genital capsule of male, lateral aspect; 64, left clasper of male, posterior aspect; 65, aedeagus of male, lateral aspect; 66, segment X of male, posterior aspect; 67, genital segments of female, dorsal aspect; 68, genital segments of female, lateral aspect.

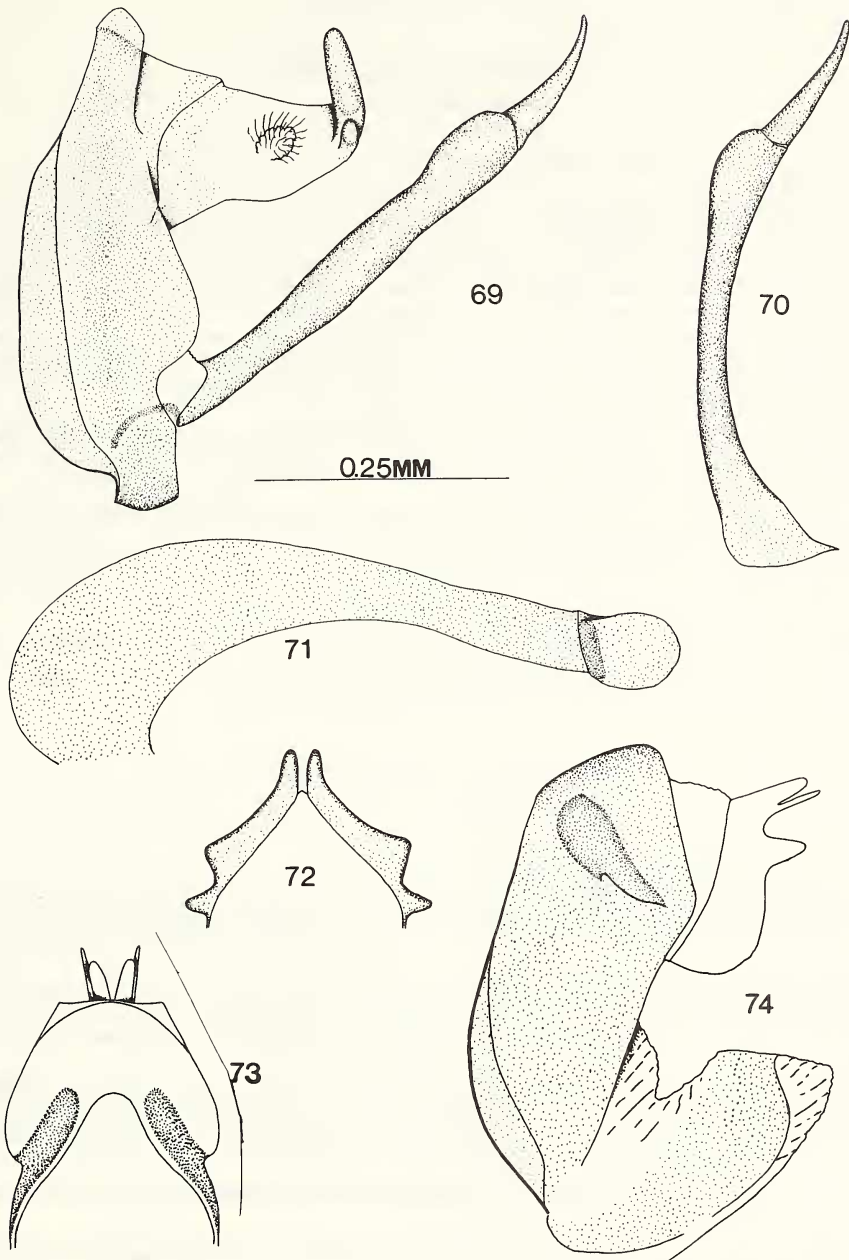


Fig. 69–74, *Cheumatopsyche lasia* Ross: 69, genital capsule of male, lateral aspect; 70, left clasper of male, posterior aspect; 71, aedeagus of male, lateral aspect; 72, segment X of male, posterior aspect; 73, genital segments of female, dorsal aspect; 74, genital segments of female, lateral aspect.

THE *CAMPYLA* GROUP*Cheumatopsyche pasella* Ross

Map 12; Fig. 75–80

*Cheumatopsyche pasella* Ross, 1941:84; Denning, 1943:144; Ross, 1944:113; Gordon, 1974:131.

**Description.**— Male fore-wing length 6.16 mm; chocolate-brown, not irrorate; with large paler areas near pterostigma, and about distal portions of Cu2 and A. These paler areas absent from female. Hind-wing tinted pale yellow-brown. Antennae uniformly brown except basal five flagellar annuli with oblique, darker bands; darker in female. Vertex dark chocolate-brown; darker in female. Spurs pale grey-brown; except latero-apical spur of fore-leg hyaline, finer, shorter than mesal companion. Female fore-leg latero-apical spur not hyaline, but finer, shorter than mesal companion. Thorax dark chocolate-brown, to deep red-brown laterally. Legs pale red-brown.

**Genitalia.** Male. (Fig. 75–78). (Specimen from Huberdeau, Québec). Males distinguished by darkly sclerotised cross-shaped pattern which links segment IX with tergum X (Fig. 75); by distal article of clasper very thin in lateral aspect, curved dorsad (Fig. 76); and by thin, high distal lobes of tergum X with deep, narrow cleft between them and main body of tergum X (Fig. 75) – these lobes close to each other in posterior aspect.

**Genitalia.** Female. (Fig. 79–80). (Specimen from Huberdeau, Québec). Females differentiated by clasper receptacle, in lateral aspect (Fig. 80), slightly tapered distally; by evident inner opening; by angular incision of clasper receptacle outer margin directed antero-dorsad; and by small, thin, distally little-widened sclerotised strap of vulval scale.

**Biology.**— Neves (1979) records from Massachusetts give a flight season of May to August, no peak mentioned. Ross (1944) indicates that this species prefers faster streams; his two Illinois records indicate that larvae also inhabit larger, slow-flowing rivers. Gordon & Wallace (1975) give major larval habitat as fallen trees and branches in flowing waters.

**Distribution.**— Presently recorded from Oregon, in a narrow zone across northern United States, then east to Québec and Maine, and south to Oklahoma and Florida (Map 12). In Canada it is known only from southern Québec and southern Ontario.

*Cheumatopsyche mickeli* Denning

Map 13; Fig. 81–86

*Cheumatopsyche mickeli* Denning, 1942:50; Ross, 1944:294; Gordon, 1974:132.

**Description.**— Male fore-wing length 6.86 mm; pale grey-brown, no pattern. Antennae yellow-brown; basal five flagellar annuli each with oblique, dark band; basal four in female. Vertex dark chocolate-brown, warts paler. Spurs brown; lateral member of middle and hind-leg pairs shorter than mesal companions. Thorax dark brown, to paler laterally. Legs pale reddish brown.

**Genitalia.** Male. (Fig. 81–84). (Specimen from Twenty-mile Ck., Lake Co., Oregon, USA). Males distinguished by preanal appendage tall, narrow, bowed anterad (Fig. 81); by distal article of clasper tapered fairly abruptly distad, recurved, in lateral aspect (Fig. 82); and by distal lobes of tergum X with small, squat process anteriorly on base of lobe (Fig. 81, 84).

**Genitalia.** Female. (Fig. 85–86). (Specimen from Twenty-mile Ck., Lake Co., Oregon, USA). Females distinguished by clasper receptacle set very high on lateral wall of segment X (Fig. 86); by inner opening evident in lateral aspect; by incision of outer margin largish, rounded; and by sclerotised strap of vulval scale inverted-triangular in lateral aspect (Fig. 86), saddle-like over dorsum of scale, not in contact with basal angle of segment X.

**Biology.**— Anderson's few records for Oregon indicate a flight season from at least early June to early September. Nothing more known.

**Distribution.**— Not yet known from Canada, this species is patchily recorded from México to Oregon, Idaho, and Wyoming (Map 13).

*Cheumatopsyche campyla* Ross

Map 14; Fig. 87–92

*Cheumatopsyche campyla* Ross, 1938b:152; Denning, 1943:148; Ross, 1944:113; Gordon, 1974:130; Schmid, 1980:144–149.

*Description.*— Male fore-wing length 8.35 mm; light grey-brown, with general faint irroration. Hind-wing faintly tinted brown (stronger tint in female). Antennae pale yellow-brown; basal five flagellar annuli each with oblique, dark band. Vertex very dark brown. Spur pairs of middle leg with lateral members shorter than mesal companions. Thorax dark reddish brown, to dull orange-brown laterally (chocolate-brown in female). Legs pale brown to straw.

*Genitalia.* Male. (Fig. 87–90). (Specimen from Wandering R., Hwy 63, 3 miles S of Wandering River, Alberta). Males distinguished by very evident dorsal lobes of segment IX, in lateral aspect (Fig. 87); by tall, clavate distal lobes of tergum X, in lateral aspect (Fig. 87); by distal lobes of tergum X close together in posterior aspect (Fig. 90); and by gently tapered black band dorsally on segment IX, curved slightly postero-ventrad.

*Genitalia.* Female. (Fig. 91–92). (Specimen from Wandering R., Hwy 63, 3 miles S of Wandering River, Alberta). Females distinguished by inner opening of clasper receptacle evident in lateral aspect (Fig. 92); by anterior and posterior ends of outer margin of clasper receptacle at same level; and by incision of that margin large, angular, directed posterad.

*Biology.*— As indicated by distribution, this species appears to be ubiquitous in its habitat preferences. It is recorded from the depths of the Boreal Forest, to deep in the heart of Texas. I have Canadian records which range from creeks to the largest rivers, some of which are deep, smooth-flowing waters, others are turbulent. Flight season, based on Canadian records, ranges from May 5 to Sept. 18 (Ontario) and October 12 (both Nova Scotia and Vancouver Island). The species may be bivoltine in the southern United States. Larvae are most commonly found out of the main current, in the backwaters, etc. Ross (1944) indicates that larvae of this species are very tolerant of pollution.

*Distribution.*— Virtually throughout the Continent, south of the northern tree line (Map 14). In Canada it has been recorded from south-central British Columbia, northern Alberta, northern Québec, Labrador, Newfoundland, and points south.

### *Cheumatopsyche ela* Denning

Map 15; Fig. 93–98

*Cheumatopsyche ela* Denning, 1942:50; Ross, 1944:294; Gordon, 1974:130.

*Description.*— Male fore-wing length 7.72 mm; overall pale red-brown. Hind-wing very palely tinted brown, with anal lobe uniform pale grey-brown. Antennae dark brown; basal five flagellar annuli with oblique, dark band. Vertex dark chocolate-brown. Spurs straw-coloured. Thorax very dark chocolate-brown, to very dark reddish brown laterally. Legs warm reddish brown.

*Genitalia.* Male. (Fig. 93–96). (Specimen from St Hippolyte, Québec). Males distinguished by very distinct dorsal lobes of segment IX, in lateral aspect (Fig. 93); by distal lobes of tergum X clearly separated from main body of tergum X by shallow, rounded notch; by distal lobes, in posterior aspect, close together (Fig. 95); and by tergum X clearly delimited from segment IX by marginal declivity of segment IX.

*Genitalia.* Female. (Fig. 97–98). (Specimen from St Hippolyte, Québec). Females distinguished by anterior end of clasper receptacle outer margin lower than posterior end (Fig. 97); by outer margin with incision angular, directed dorsad; by receptacle directed antero-dorsad; and by inner opening of receptacle not evident in lateral aspect.

*Biology.*— Records few, but flight season in eastern United States ranges from April to July. Roy & Harper (1979) give known flight season in southern Québec as June 25 to August 7. Little seems to be known of stream types favoured by larvae.

*Distribution.*— Scattered records from Tennessee and South Carolina to southern Québec (Map 15). To date Canadian records are all from the Ottawa–St Lawrence rivers drainage.

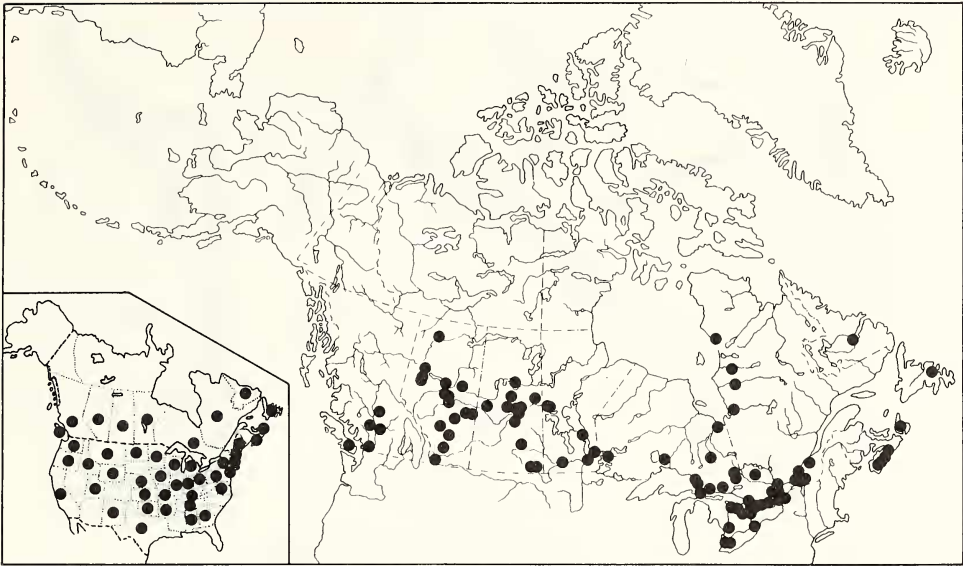


Map 12. Collection localities for *Cheumatopsyche pasella* Ross in Canada, with known distribution in North America by state or province.

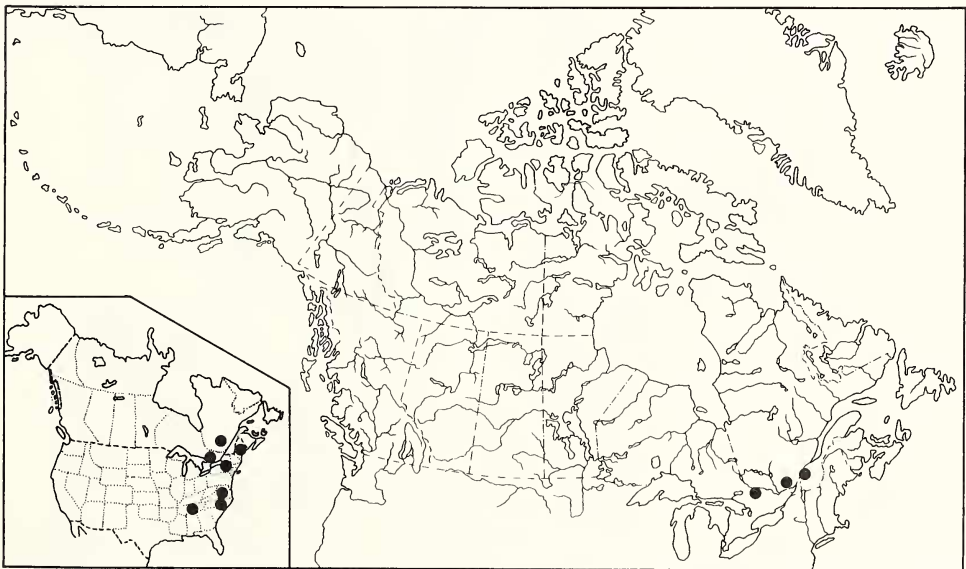


Map 13. Known distribution of *Cheumatopsyche mickeli* Denning in North America, by state.





Map 14. Collection localities for *Cheumatopsyche campyla* Ross in Canada, with known distribution in North America by state or province.



Map 15. Collection localities for *Cheumatopsyche ela* Denning in Canada, with known distribution in North America by state or province.

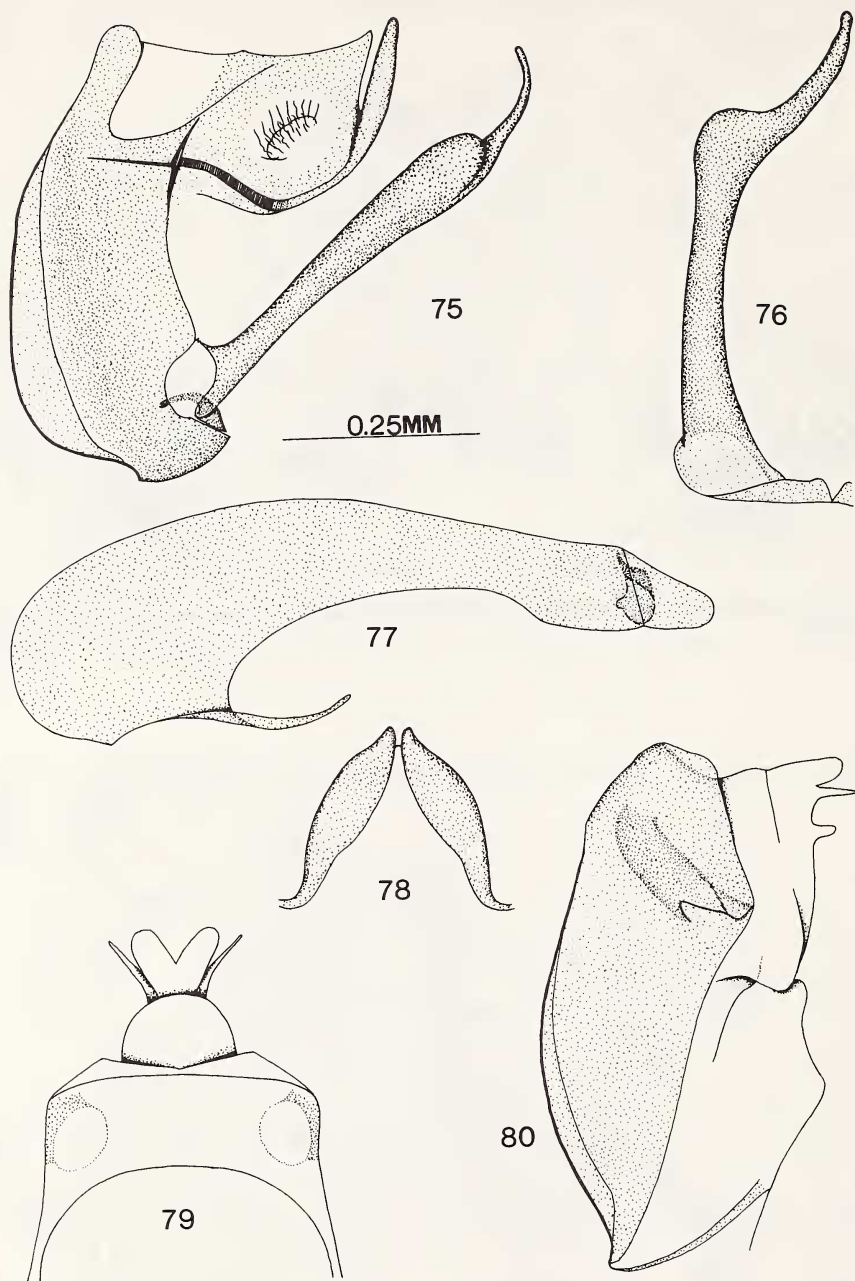


Fig. 75-80, *Cheumatopsyche pasella* Ross: 75, genital capsule of male, lateral aspect; 76, left clasper of male, posterior aspect; 77, aedeagus of male, lateral aspect; 78, segment X of male, posterior aspect; 79, genital segments of female, dorsal aspect; 80, genital segments of female, lateral aspect.

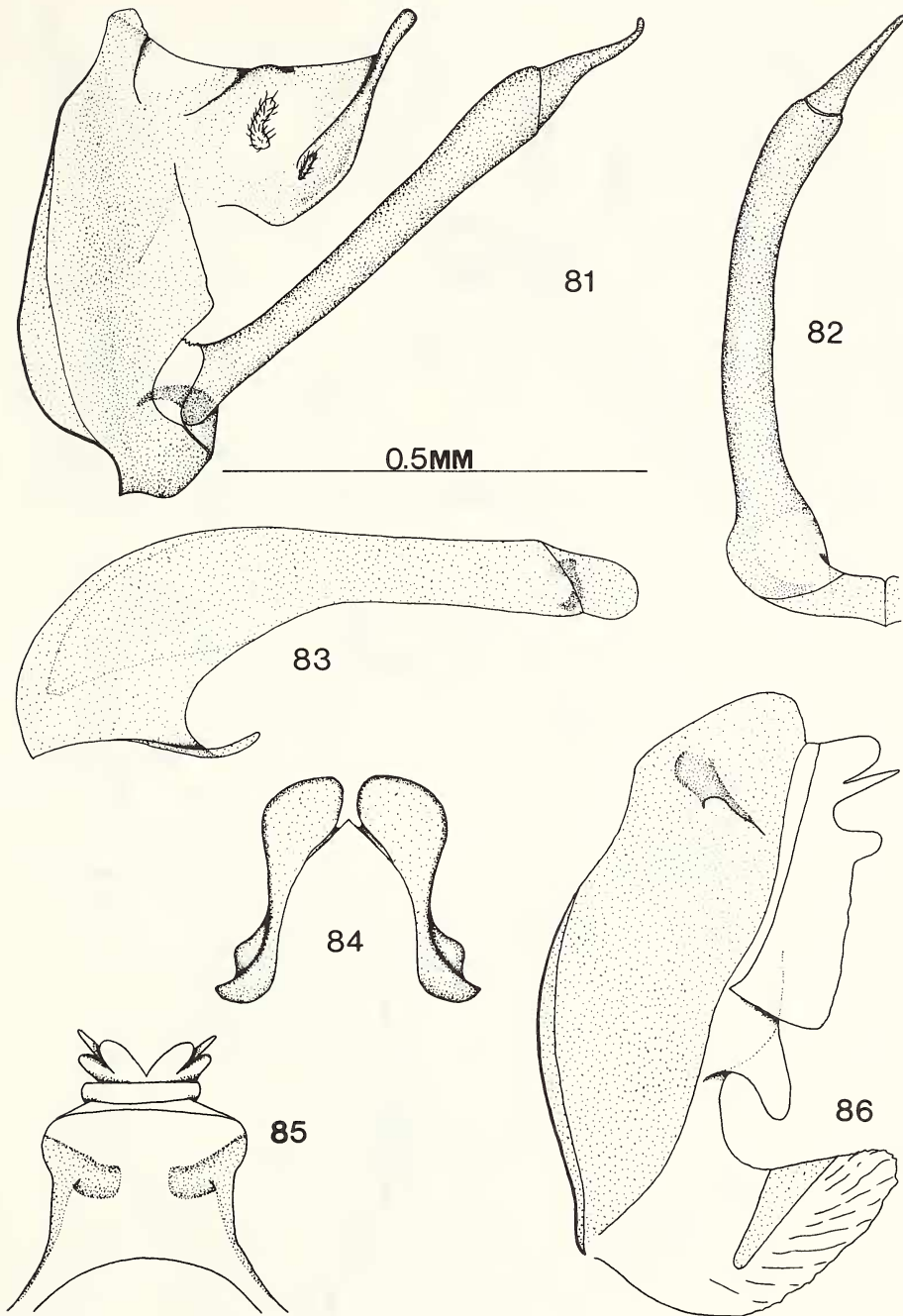


Fig. 81-86, *Cheumatopsyche mickeli* Denning: 81, genital capsule of male, lateral aspect; 82, left clasper of male, posterior aspect; 83, aedeagus of male, lateral aspect; 84, segment X of male, posterior aspect; 85, genital segments of female, dorsal aspect; 86, genital segments of female, lateral aspect.

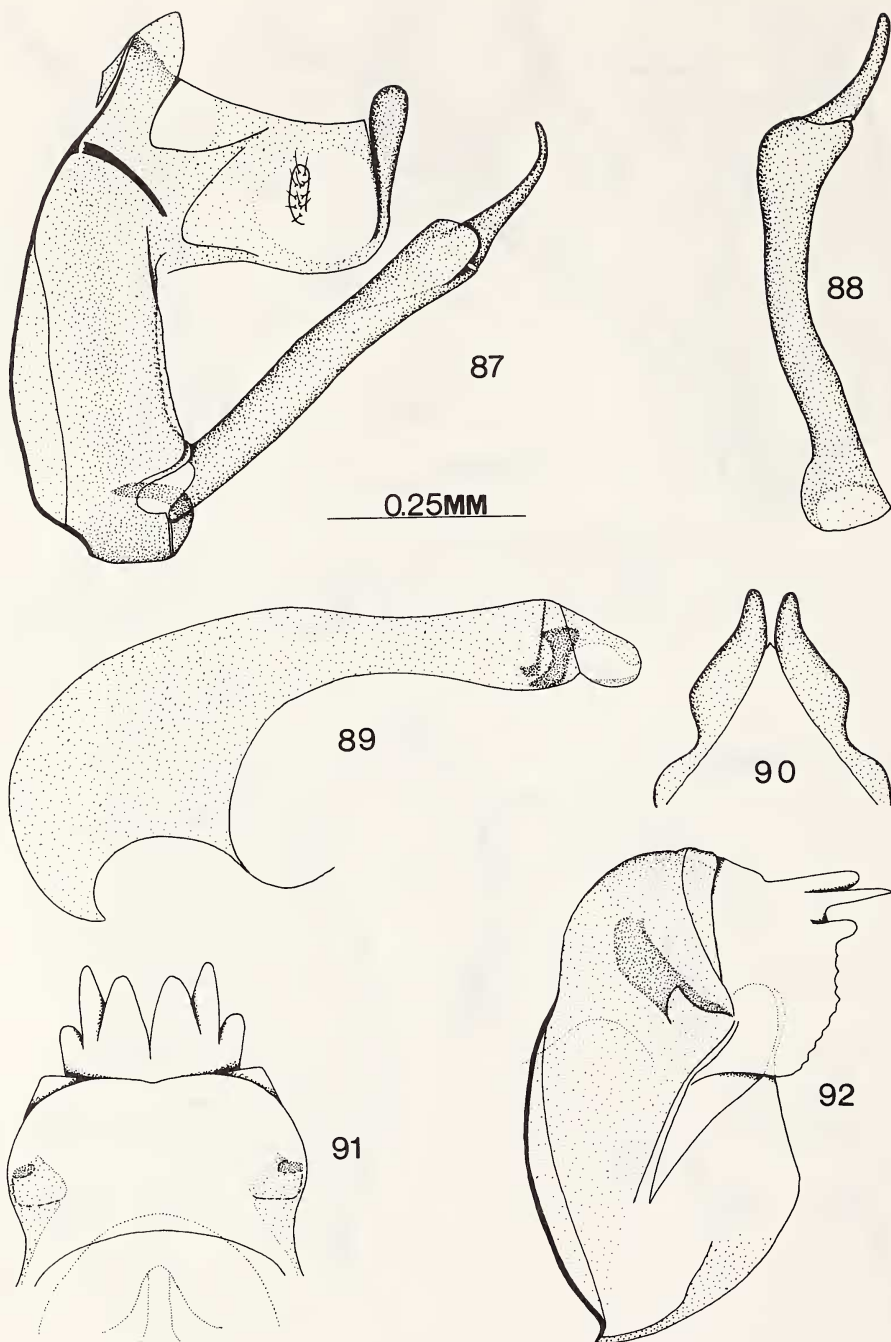


Fig. 87–92, *Cheumatopsyche campyla* Ross: 87, genital capsule of male, lateral aspect; 88, left clasper of male, posterior aspect; 89, aedeagus of male, lateral aspect; 90, segment X of male, posterior aspect; 91, genital segments of female, dorsal aspect; 92, genital segments of female, lateral aspect.

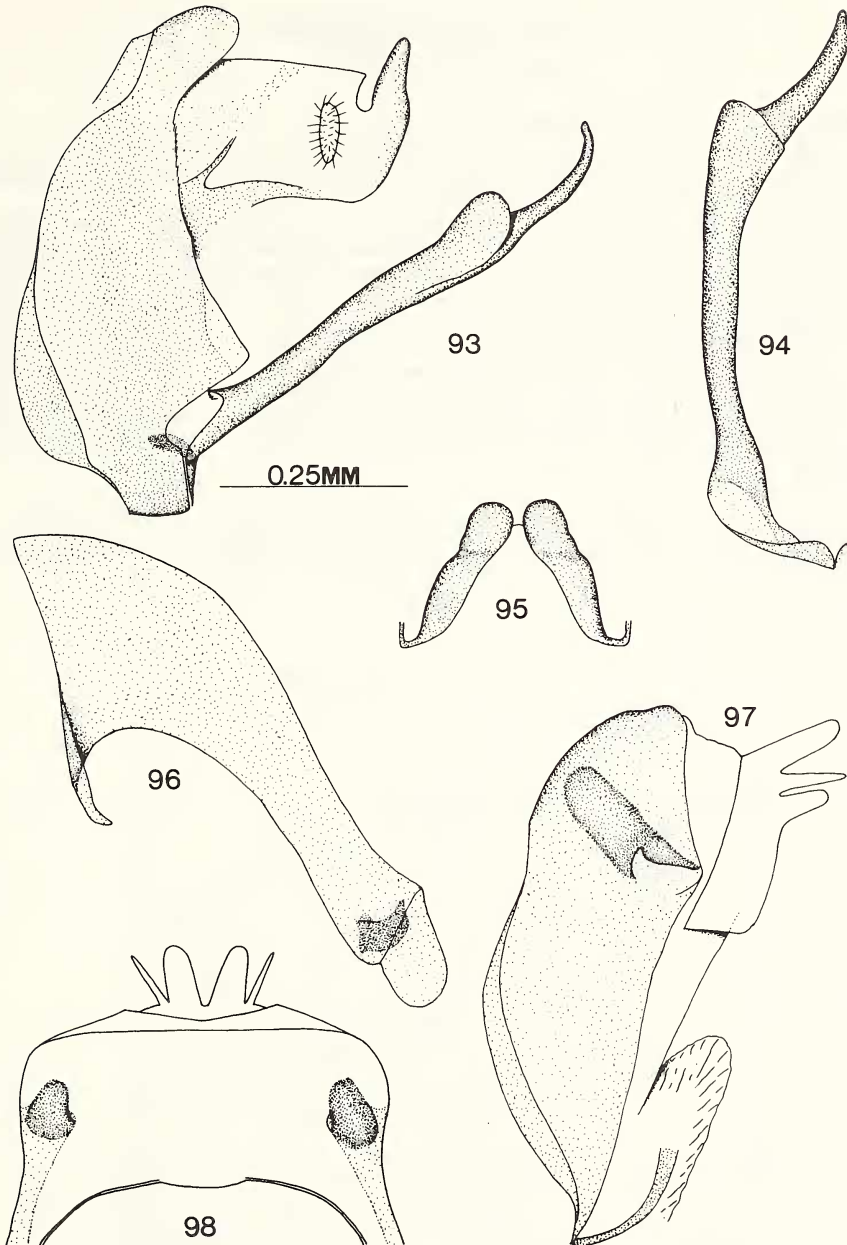


Fig. 93-98, *Cheumatopsyche ela* Denning: 93, genital capsule of male, lateral aspect; 94, left clasper of male, posterior aspect; 95, segment X of male, posterior aspect; 96, aedeagus of male, lateral aspect; 97, genital segments of female, lateral aspect; 98, genital segments of female, dorsal aspect.

## THE WABASHA GROUP

*Cheumatopsyche wabasha* Denning  
Map 16; Fig. 99–102

*Cheumatopsyche wabasha* Denning, 1947:252; Gordon, 1974:130.

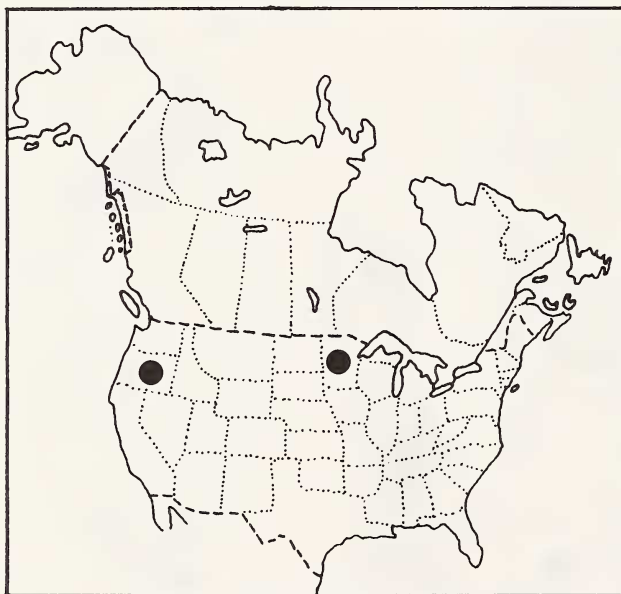
**Description.**— Male fore-wing length 6.7 mm; deep translucent red-brown; very faintly irrorate. Hind-wing paler, no irroration. Antennae missing; basal segment dark brown. Vertex very dark brown to chocolate. Thorax chocolate to almost black. Legs dark brown to chocolate.

**Genitalia.** Male. (Fig. 99–102). (Specimen from Wabasha, Minnesota, USA – Holotype). Gordon used an Oregon specimen for her illustrations of the male, and description. That specimen was apparently not deformed, as she refers to the distal deformation of the aedeagus of the male holotype (see Fig. 102 here). She makes no reference to the deformation of the distal lobes of tergum X as evinced in either lateral or posterior aspects (Fig. 99 & 100 here). Just which, if any, of the distal lobes borne by the holotype should be regarded as normal for the species is open to doubt. Gordon's illustrations of the Oregon specimen seem to show a third type of lobe (posterior aspect). Loss of tergum X distal lobes as reliable characters is unfortunate, but the holotype, and the Oregon specimens appear to agree in having dorsum of tergum X level, almost at same height as dorsal lobes of segment IX (Fig. 99). Also, the preanal appendages agree in being located almost on the base of the distal lobes. The distal article of the clasper is very narrow throughout, in lateral aspect, and sharply hooked dorsad at distal end; in posterior aspect (Fig. 101) clasper distal article curved posterad, with relatively wide base, distally acuminate.

**Genitalia.** Female. Unknown.

**Biology.**— Unknown except that both Minnesota and Oregon adult records are for July.

**Distribution.**— Presently known only from Minnesota and Oregon, in the United States (Map 16).



Map 16. Known distribution of *Cheumatopsyche wabasha* Denning in North America, by state.

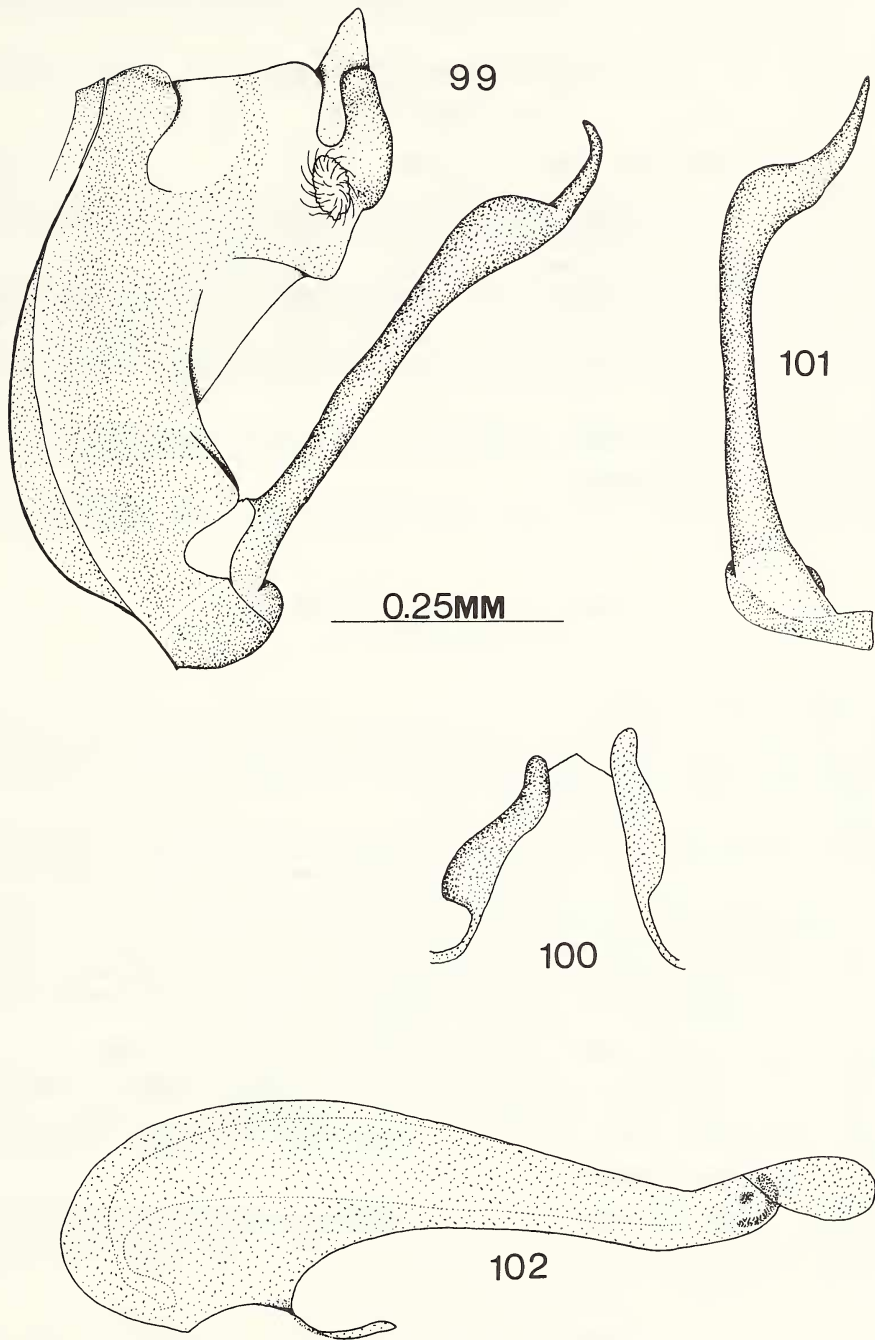


Fig. 99-102, *Cheumatopsyche wabasha* Denning: 99, genital capsule of male, lateral aspect; 100, segment X of male, posterior aspect; 101, left clasper of male, posterior aspect; 102, aedeagus of male, lateral aspect.

## THE ROSSI GROUP

*Cheumatopsyche logani* Gordon & Smith

Map 18; Fig. 103–106

*Cheumatopsyche logani* Gordon & Smith, 1974:1; Gordon, 1974:128.

**Description.**— Male fore-wing length 6.94 mm; pale brownish cream; no evident pattern – may be teneral. Antennae pale straw, no markings on flagellar annuli; scape brown, with cream-coloured areas baso-laterad; pedicel brown, with posterior area cream. Vertex red-brown, warts almost white. Legs straw-coloured.

**Genitalia.** Male. (Fig. 103–106). (Specimen from Little Salmon R., Adams Co., Idaho, USA – Holotype). Males distinguished by distal article of clasper with basal half evenly tapered; distal half uniformly thin, curved dorso-anterad, in lateral aspect (Fig. 103). Distal article of clasper, in posterior aspect, directed postero-mesad, with tip just visible, directed mesad (Fig. 105). Dorsum of tergum X sloped postero-ventrad directly from dorsum of segment IX. Preanal appendage globular, close to base of tergum X distal lobes. Distal lobes of tergum X separated from main body of tergum by shallow, narrowly v-shaped notch; close together in posterior aspect (Fig. 104).

**Genitalia.** Female. Unknown.

**Biology.**— The only flight records available are June 3 and 29, in Washington and Idaho respectively. Otherwise nothing known.

**Distribution.**— Presently recorded only from Washington, Idaho, and Montana, in the United States (Map 18).

*Cheumatopsyche smithi* Gordon

Map 19; Fig. 107–112

*Cheumatopsyche smithi* Gordon, 1974:128.

**Description.**— Male fore-wing length 8.42 mm; warm golden brown; paler areas only at distal end of A. Female more distinctly irrorate. Antennae brown; basal six flagellar annuli with oblique, dark brown bands; dark yellowish brown in female. Spurs brownish yellow; lateral member of middle leg pairs notably shorter than mesal companions. Thorax dark reddish brown, to greyish brown laterally. Legs pale yellowish brown.

**Genitalia.** Male. (Fig. 107–110). (Specimen from Wandering R., Hwy 63, N of Wandering River, Alberta). Males distinguished by basal article of clasper very stout, expanded evenly distad, extended dorsad of tergum X; by distal article of clasper minute by comparison with basal article, tapered distad to fine point, recurved; by distinct dorsal lobes of segment IX (Fig. 107); by distal lobes of tergum X well separated from main body of tergum X by narrow cleft, in lateral aspect (Fig. 110), with dorsal portion expanded, rounded, flared dorso-laterad; and by small, circular preanal appendages.

**Genitalia.** Female. (Fig. 111–112). (Specimen from Wandering R., Hwy 63, N of Wandering River, Alberta). Females distinguished by clasper receptacle expanded distally, in lateral aspect (Fig. 112), with inner end very slightly cleft; by outer margin of receptacle incised, rounded, incision located at anterior end of margin; by receptacle directed postero-dorsad; and by sclerotised strap of vulval scale narrow, tapered to fine point distally.

**Biology.**— Flight season records for Canada range from May 18 to August 12, with imprecisely defined concentration in June and July. Larvae appear to inhabit a variety of stream types, from smaller creeks to large rivers, and slower deep waters to fast-flowing waters on gravel or boulder beds. Records are available from the Vancouver Island rain forest, the Boreal Forest, prairies, and far southern Ontario.

**Distribution.**— Recorded to date from Vancouver Island and southern British Columbia, to southern Ontario, and three States of the Union adjacent to the Canadian border (Map 19). In Canada most records are from Alberta.

*Cheumatopsyche pettiti* (Banks)

Map 17; Fig. 113–118

*Hydropsyche pettiti* Banks, 1908:265; Milne, 1936:73 (with *H. analis* Banks as synonym of *H. morosa*).*Hydropsychodes pettiti*; Betten, 1934:195.*Cheumatopsyche pettiti*; Knowlton & Harmston, 1938:285; Denning, 1943:145; Ross, 1944:294 (as synonym of *C. analis*



**Nimmo, A. P. (1987, 1-189).- The adult Arctopsychidae and Hydropsychidae (Trichoptera) of Canada and adjacent United States**

**CORRIGENDA**

**pages**

49 “(Fig. 17)” in the last paragraph should read “(Map 17)”.

49-50 Captions for maps are in correct places but maps should be rearranged as follows:

Map at	should go to
17	18
19	17
18	19



Banks; Gordon, 1974:127, 143 (*C. analis* as *nomina dubia*).

*Hydropsyche analis* Banks, 1903:243; Milne, 1936:73 (as synonym of *H. morosa*); Ross, 1944:112.

*Hydropsychodes analis*; Betten, 1934:194.

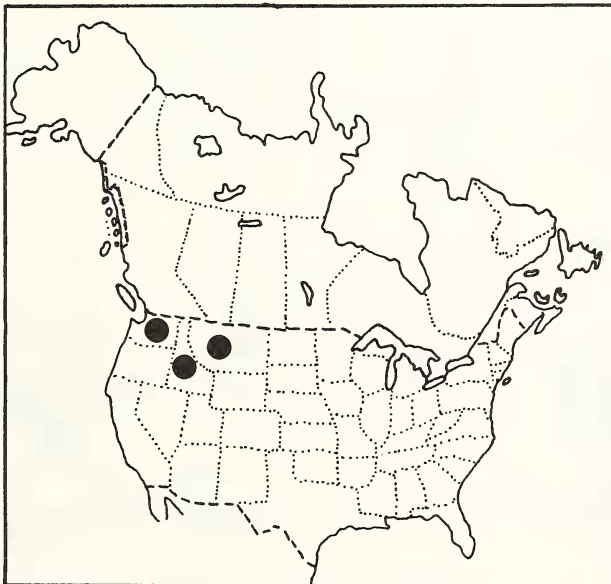
**Description.**— Male fore-wing length 7.41 mm; pale grey-brown. Hind-wing hyaline. Antennae brown; basal four flagellar annuli with oblique, dark band; basal five annuli in female. Vertex deep red-brown. Spurs brown; lateral member of fore-leg pair finer than mesal companion, hyaline; lateral member of middle leg sub-apical pair shorter than mesal companion. Thorax deep red-brown, to paler laterally. Legs dark straw-coloured.

**Genitalia.** Male. (Fig. 113–116). (Specimen from R. Maskinonge, Ste Angèle, Québec). Males distinguished by distal lobes of tergum X very well separated from main body of tergum X, in lateral aspect (Fig. 113); by distal lobes of tergum X, in posterior aspect (Fig. 116), not particularly close to each other, widened distally, with distal ends flared somewhat laterad; by dorsal lobes of segment IX clearly evident; and by distal article of clasper more or less confluent with basal article, in posterior aspect (Fig. 114).

**Genitalia.** Female. (Fig. 117–118). (Specimen from R. Maskinonge, Ste Angèle, Québec). Females distinguished by clasper receptacle directed antero-dorsad, in lateral aspect (Fig. 118); by outer margin of receptacle not incised, continued anterad on lateral face of segment X by thin, black line; by inner opening of clasper receptacle not evident in lateral aspect; and by sclerotised strap of vulval scale located well away from segment X, basally thin, distally greatly expanded to poorly sclerotised area which extends from dorsal to ventral regions of scale.

**Biology.**— Anderson (1976) summarizes present knowledge of the species. Larvae appear to prefer smaller streams, but are also recorded from larger rivers. First adults to emerge are very dark, followed by successively lighter individuals as season progresses. Flight season based on Canadian records ranges from May 11 to October 13, with no pronounced peak.

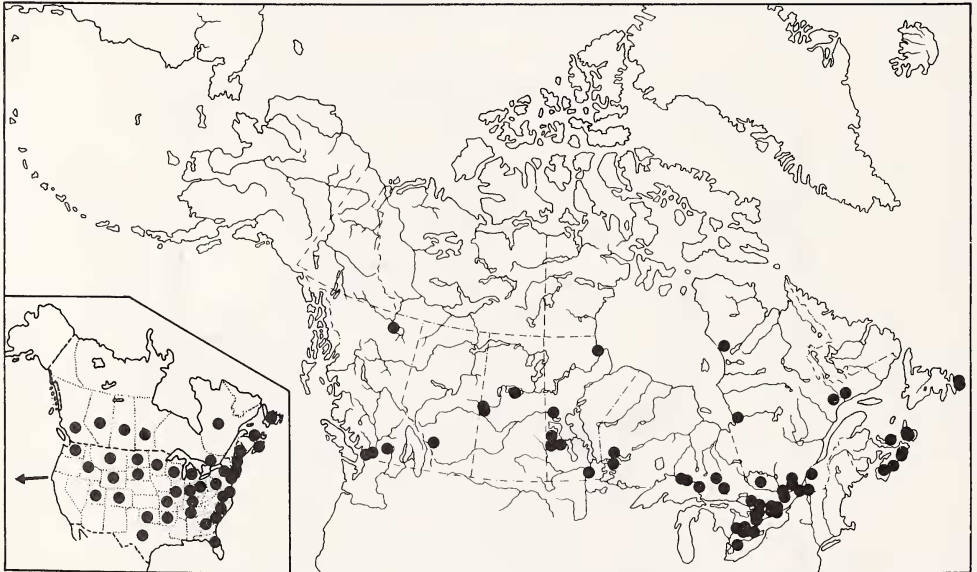
**Distribution.**— Known from across North America (Fig. 17), and from northern reaches of the Boreal Forest south to Texas. Apparently not yet recorded from the southeastern United States. In Canada this species is known from northern British Columbia, the western and eastern shores of Hudson's Bay, Newfoundland, and points south to the United States border. It appears that this species has also been introduced to Hawaii.



Map 17. Collection localities for *Cheumatopsyche pettiti* (Banks) in Canada, with known distribution in North America by state or province.



Map 18. Known distribution of *Cheumatopsyche logani* Gordon in North America, by state.



Map 19. Collection localities for *Cheumatopsyche smithi* Gordon in Canada, with known distribution in North America by state or province.

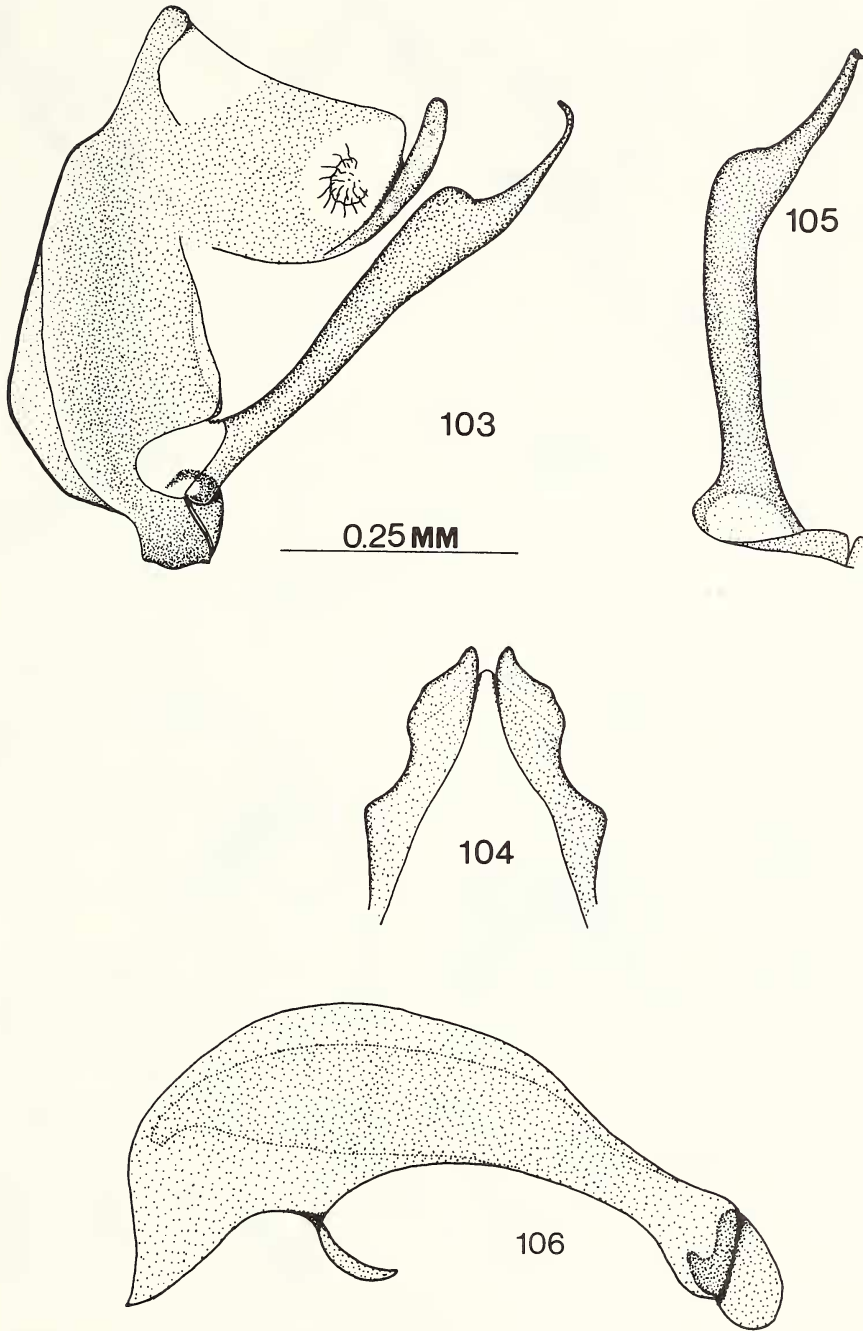


Fig. 103–106, *Cheumatopsyche logani* Gordon: 103, genital capsule of male, lateral aspect; 104, segment X of male, posterior aspect; 105, left clasper of male, posterior aspect; 106, aedeagus of male, lateral aspect.

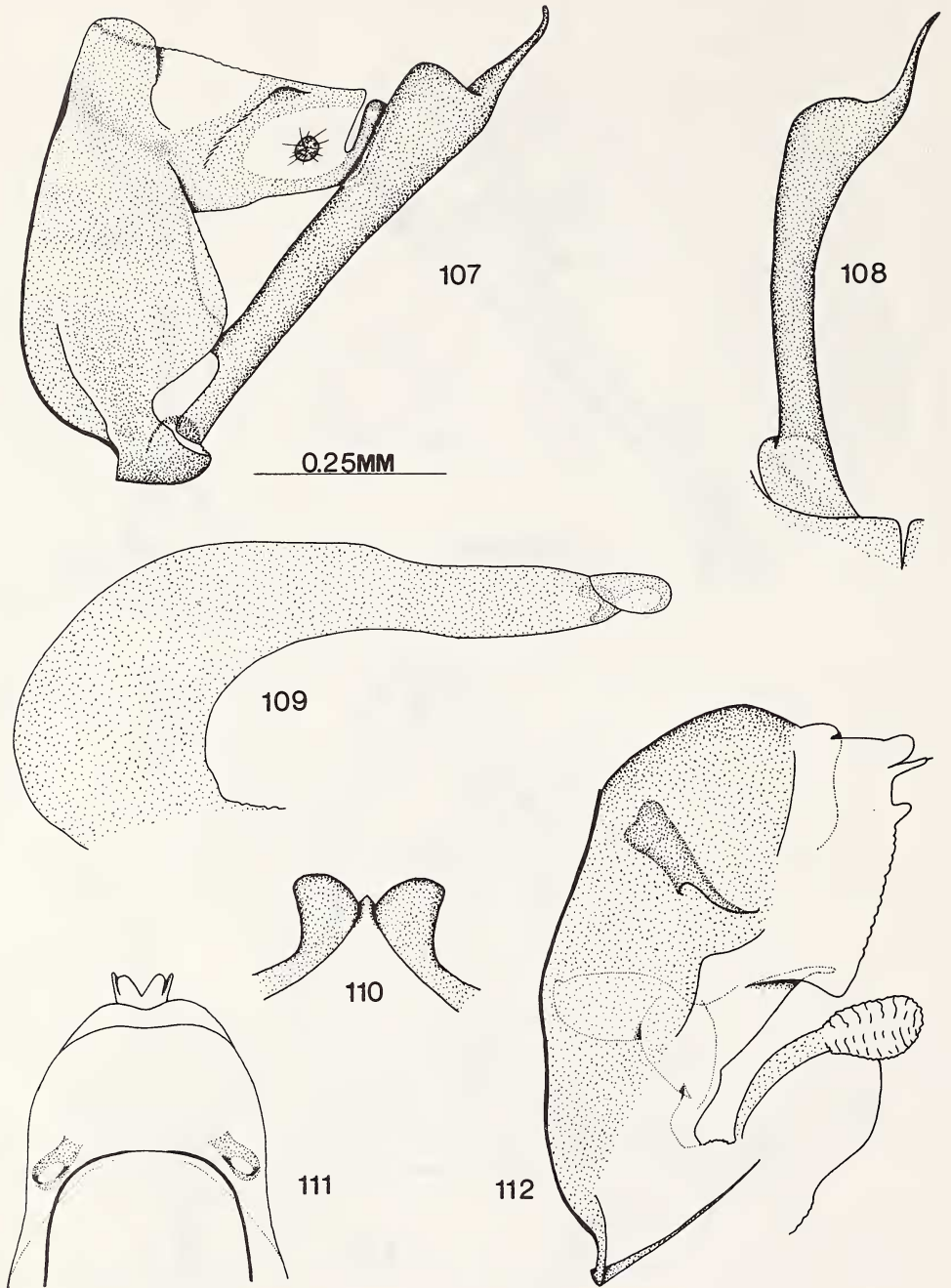


Fig. 107-112, *Cheumatopsyche smithi* Gordon: 107, genital capsule of male, lateral aspect; 108, left clasper of male, posterior aspect; 109, aedeagus of male, lateral aspect; 110, segment X of male, posterior aspect; 111, genital segments of female, dorsal aspect; 112, genital segments of female, lateral aspect.

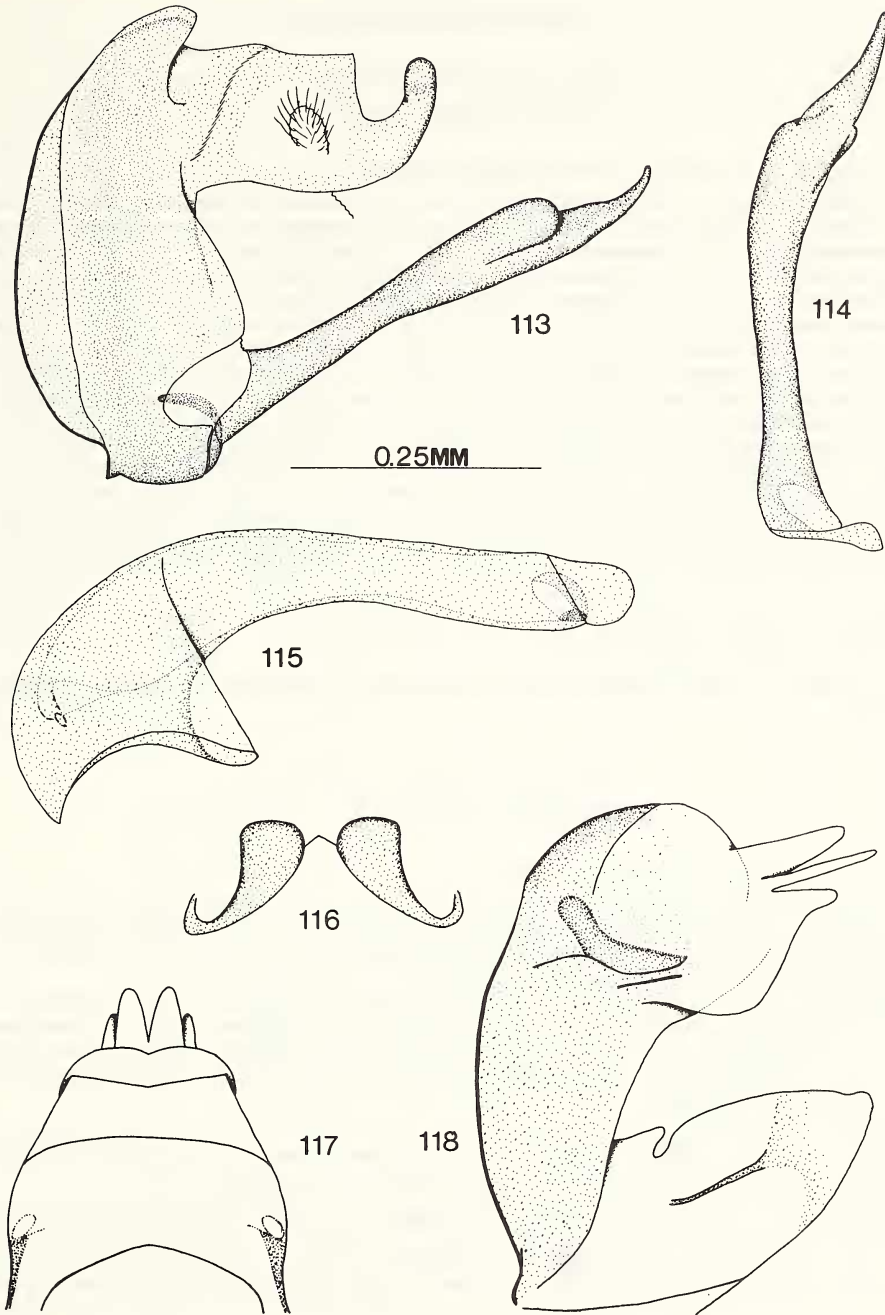


Fig. 113–118, *Cheumatopsyche pettiti* (Banks): 113, genital capsule of male, lateral aspect; 114, left clasper of male, posterior aspect; 115, aedeagus of male, lateral aspect; 116, segment X of male, lateral aspect; 117, genital segments of female, dorsal aspect; 118, genital segments of female, lateral aspect.

THE *HELMA* GROUP*Cheumatopsyche helma* Ross

Map 20; Fig. 119–124

*Cheumatopsyche helma* Ross, 1939:68; Ross; 1944:294; Gordon, 1974:135.

**Description.**— Male fore-wing length 5.03 mm; overall warm, deep red brown; no evident pattern. Antennae brown; basal five flagellar annuli each with oblique, faintly darker band. Vertex uniform dark brown. Spurs dark brown; lateral member of middle leg pairs shorter than mesal companions; lateral member of front leg apical pair minute, hyaline (normal in female). Thorax dark brown, to dull grey-brown laterally. Legs brownish yellow.

**Genitalia.** Male. (Fig. 119–122). (Specimen from Pineville, Kentucky, USA – Paratype). Males distinguished by dorsal lobes of segment IX (Fig. 119); by small preanal appendage about mid-point along length of tergum X; by distal lobes of tergum X, in lateral aspect, triangular, antero-dorsal corner directed anterad; by distal lobes of tergum X, in posterior aspect, clearly separated by higher, intermediate, angular roof of tergum (Fig. 120); by distal lobes with acuminate dorso-lateral lobes, in posterior aspect, directed laterad; by segment IX tall, narrow in lateral aspect, with no posterior projection of postero-lateral edge (compare Fig. 119 & 113); and by distal article of clasper much thinner than basal article, almost straight in lateral and posterior aspect (Fig. 119, 121), with little taper.

**Genitalia.** Female. (Fig. 123–124). (Specimen from Gatlinburg, Tennessee, USA). Females distinguished by very large clasper receptacle, in lateral aspect (Fig. 124), curved dorso-posterad, of uniform width; by inner opening of clasper receptacle not evident in lateral aspect; by outer margin of receptacle incised at anterior end – incision minute, narrow, short, directed dorsad; by anterior end of outer margin of receptacle continued by, but not connected to, thin, dark line across lateral face of segment X; and by large sclerotised strap of vulval scale, with dorsal area of sclerotisation also present.

**Biology.**— Blickle & Morse (1966) record adult collection dates from July 8 to 30, in Maine. Nothing more known at present.

**Distribution.**— Presently known only from Tennessee, Kentucky, and Maine, in the USA (Map. 20).

*Cheumatopsyche wrighti* Ross

Map 21; Fig. 125–128

*Cheumatopsyche wrighti* Ross, 1947:140; Gordon, 1974:136.

**Description.**— Male fore-wing length 7.87 mm; uniform warm red-brown; no evident pattern. Antennae brown; basal five flagellar annuli each with oblique, dark band. Vertex deep red-brown, warts paler. Spurs straw-coloured; lateral spurs of all pairs on middle and hind legs noticeably shorter than mesal companions. Thorax rich, deep red-brown, to partly greyish brown laterally. Legs light red-brown, to paler distally.

**Genitalia.** Male. (Fig. 125–128). (Specimen from Camp Ck, Greene Co., Tennessee, USA – Holotype). Males distinguished by distal lobes of tergum X very large, appressed anterad along lateral face of tergum X, in lateral aspect (Fig. 125); by distal lobes of tergum X with posterior edge, in lateral aspect, shouldered; by total lack of dorsal lobes of segment IX; by distal lobes of tergum X close in posterior aspect (Fig. 126), tapered dorso-mesad; and by recurved distal article of clasper in posterior aspect (Fig. 127).

**Genitalia.** Female. Unknown.

**Biology.**— Neves (1979) records adults from Massachusetts in June–July. The only Canadian records are from July 5 and 11. Nothing else presently known.

**Distribution.**— In the United States this species is recorded from Tennessee and the northeastern seaboard states (Map 21). In Canada there are two records: from Baddeck, Cape Breton Island, Nova Scotia, and from near Dundee in the eastern half of Prince Edward Island.

*Cheumatopsyche h. harwoodi* Denning

Map 22; Fig. 129–134

*Cheumatopsyche harwoodi* Denning, 1949:41.*Cheumatopsyche h. harwoodi*; Gordon, 1974:135.



Of the two subspecies recognised by Gordon (1974) *C. h. harwoodi* is the one most likely to be recorded from Canada.

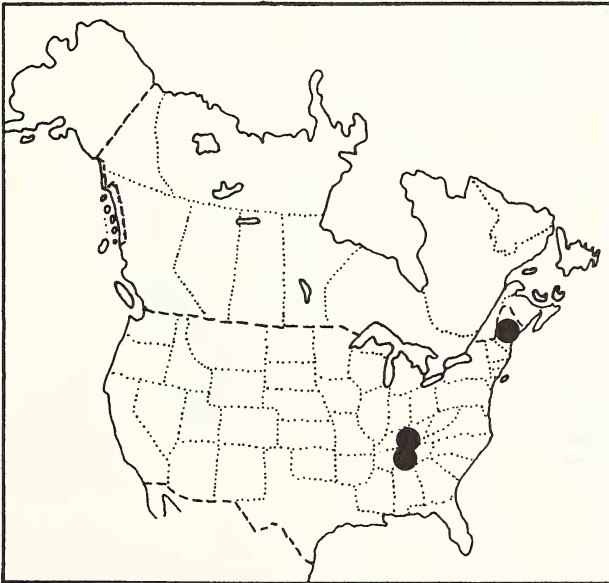
**Description.**— Male fore-wing length 6.79 mm; grey-brown. Hind-wing pearly tinted grey-brown. Antennae dark brown; basal six flagellar annuli each with oblique, dark band. Vertex chocolate; posterior warts paler. Spurs dark brown; lateral member of middle leg pairs much shorter than mesal companions. Thorax chocolate, to mixed chocolate and paler laterally. Legs dull yellowish brown.

**Genitalia.** Male. (Fig. 129–132). (Specimen from Credit R., Belfountain, Halton Co., Ontario). Males distinguished by lack of dorsal lobes on segment IX (Fig. 129); by preanal appendage vertically aligned, small, narrowly elliptical; by small, rounded notch between main body of tergum X and distal lobes; by distal lobes of tergum X, in lateral aspect (Fig. 129), slightly higher than tergum X, widest dorsally; by distal lobes of tergum X, in posterior aspect (Fig. 131), moderately separated, with dorso-lateral corners right-angled, and dorso-mesal corners rounded, produced slightly dorsad; and by basal article of clasper, in posterior aspect (Fig. 130), distally curved gently mesad, with distal half much wider – distal article of clasper with base narrower than distal end of basal article, gently curved dorsad, tapered to thin, rounded tip.

**Genitalia.** Female. (Fig. 133–134). (Specimen from Credit R., Belfountain, Halton Co., Ontario). Females distinguished by clasper receptacle of medium size, directed dorso-anterad in lateral aspect (Fig. 134), without inner opening evident; by outer margin of receptacle with deep, angular incision directed dorsad; by anterior end of outer margin continued antero-ventrad across lateral face of segment IX by thin, black, sinuate line; by sclerotised strap of vulval scale short, very thin; and by cercus of segment XI very small, short, thin, located immediately at base of dorsal lobe of segment XI.

**Biology.**— Flight season data very scarce in literature, but McElravy & Foote (1978) record possible females from Ohio on August 5. Denning's original material from Tennessee was collected on June 6. I have two records from eastern Canada – July 11 and 16. Nothing else known.

**Distribution.**— Known from most eastern states of the Union, north of Florida and Alabama, as far as Maine (Map 22). In Canada the species has been taken in Nova Scotia and Prince Edward Island.



Map 20. Known distribution of *Cheumatopsyche helma* Ross in North America, by state.



Map 21. Collection localities for *Cheumatopsyche wrighti* Ross in Canada, with known distribution in North America by state or province.



Map 22. Collection localities for *Cheumatopsyche h. harwoodi* Denning in Canada, with known distribution in North America by state or province.

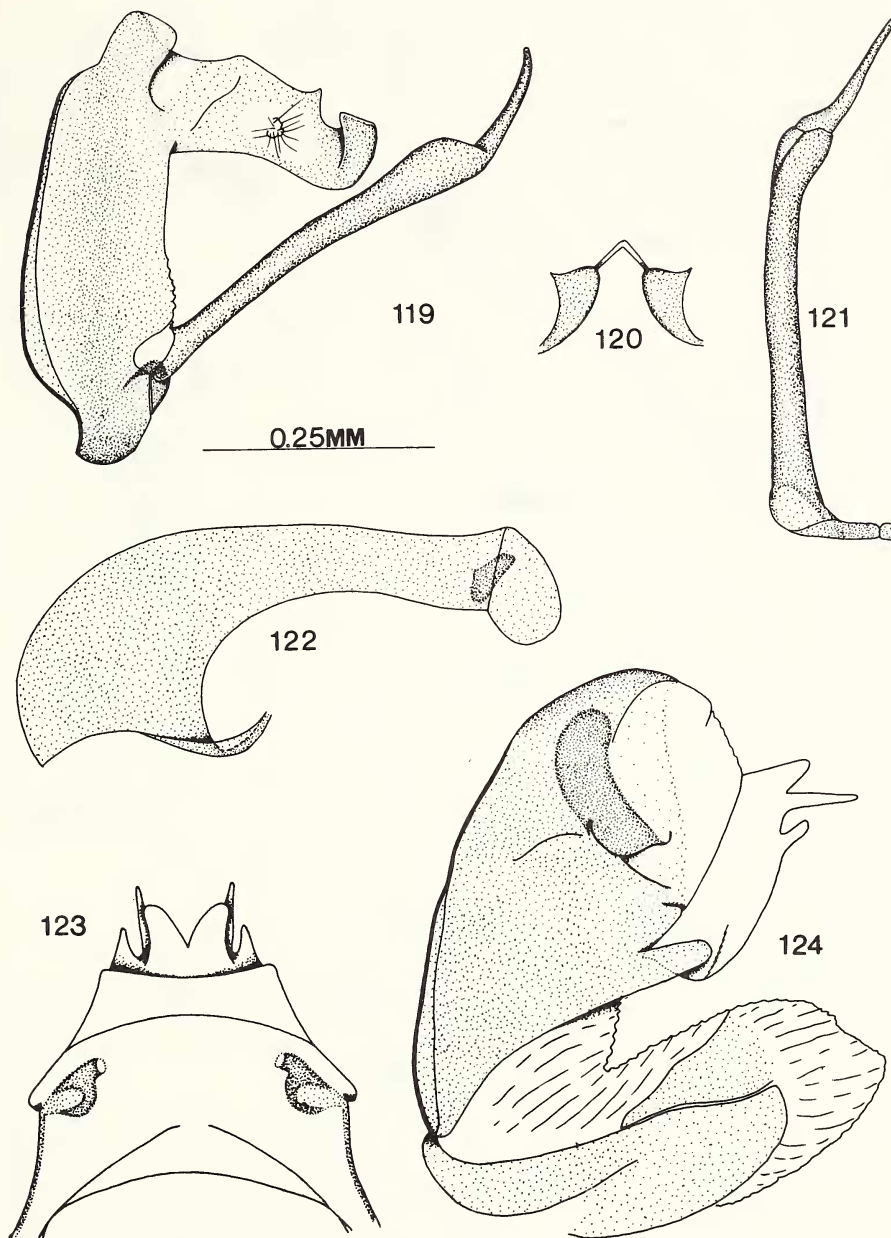


Fig. 119–124, *Cheumatopsyche helma* Ross: 119, genital capsule of male, lateral aspect; 120, segment X of male, posterior aspect; 121, left clasper of male, posterior aspect; 122, aedeagus of male, lateral aspect; 123, genital segments of female, dorsal aspect; 124, genital segments of female, lateral aspect.

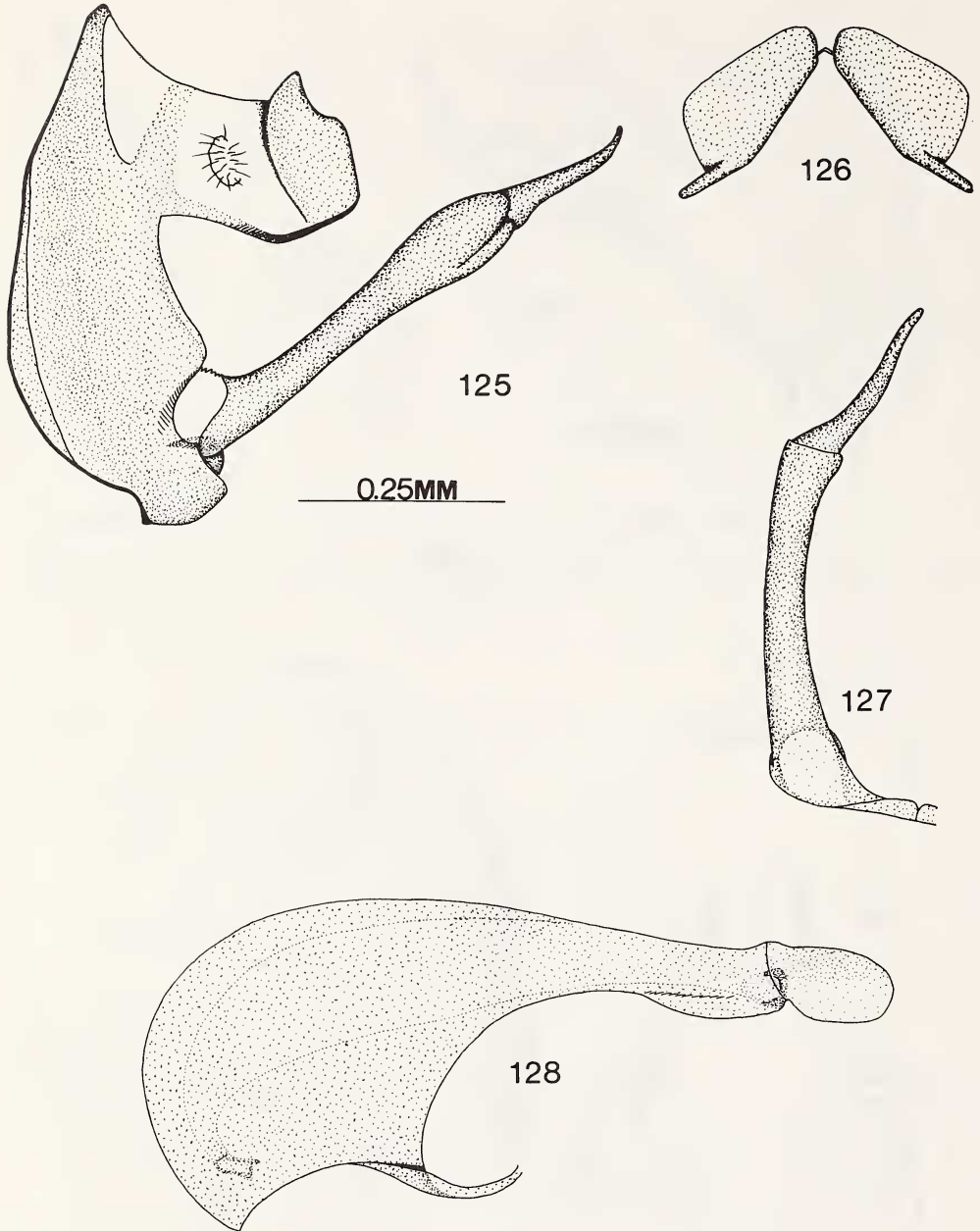


Fig. 125–128, *Cheumatopsyche wrighti* Ross: 125, genital capsule of male, lateral aspect; 126, segment X of male, posterior aspect; 127, left clasper of male, posterior aspect; 128, aedeagus of male, lateral aspect.

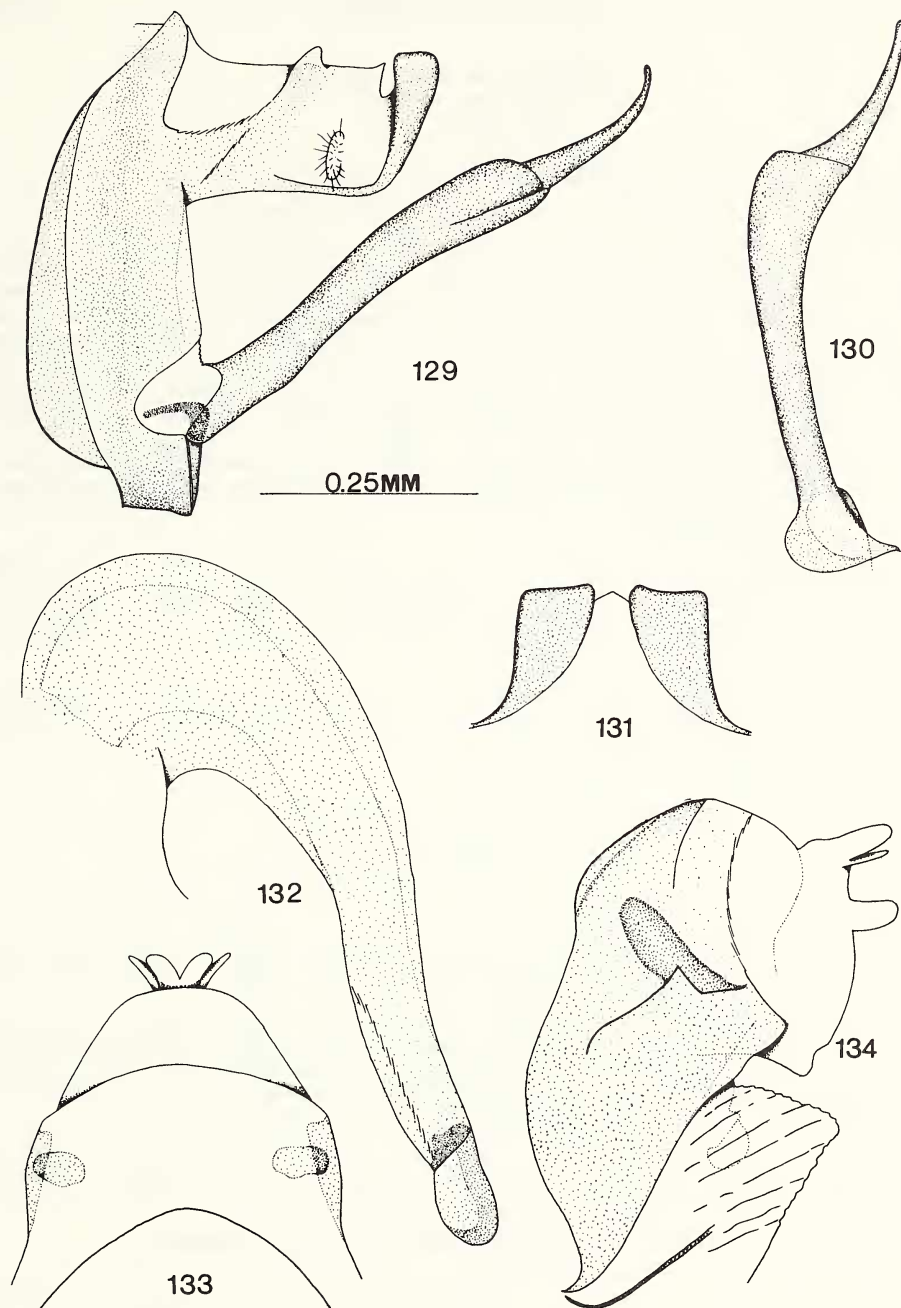


Fig. 129–134, *Cheumatopsyche h. harwoodi* Denning: 129, genital capsule of male, lateral aspect; 130, left clasper of male, posterior aspect; 131, segment X of male, posterior aspect; 132, aedeagus of male, lateral aspect; 133, genital segments of female, dorsal aspect; 134, genital segments of female, lateral aspect.

THE *GRACILIS* GROUP*Cheumatopsyche gracilis* (Banks)

Map 23; Fig. 135–140

*Hydropsyche gracilis* Banks, 1899:216; Milne, 1936:73 (as synonym of *H. morosa*).*Hydropsychodes gracilis*; Betten, 1934:197.*Cheumatopsyche gracilis*; Ross, 1938c:15; Denning, 1943:152; Ross, 1944:294; Gordon, 1974:137.

**Description.**— Male fore-wing length 6.16 mm; pale yellow-brown, with faint, scattered pattern. Antennae yellow-brown; basal five flagellar annuli each with oblique, dark brown band. Spurs yellow-brown; lateral member of middle leg pairs notably shorter than mesal companions. Thorax dark brown, to paler laterally. Legs pale yellow-brown.

**Genitalia.** Male. (Fig. 135–140). (Specimen from Waterton R., nr Standoff, Alberta). Males distinguished by lack of dorsal lobes on segment IX (Fig. 135); by tergum X sloped postero-ventrad; by preanal appendage large, ovoid; by distal lobes of tergum not separated from tergum X by gap, in lateral aspect (Fig. 135), antero-dorsal corner angular, turned slightly dorsad; by distal lobes of tergum X, in posterior aspect (Fig. 137), clearly separated, roughly triangular, with dorso-lateral corners directed dorso-laterad; and by entire clasper, in posterior aspect (Fig. 136), recurved as unit, without apparent distinction between basal and distal articles.

**Genitalia.** Female. (Fig. 139–140). (Specimen from Waterton R., nr Standoff, Alberta). Females distinguished by massive clasper receptacle (Fig. 140); outer margin of receptacle sinuate, produced ventrad as large, rounded lobe; by anterior end of outer margin of receptacle continued shortly antero-ventrad as black line; and by receptacle as whole located very high in segment IX, almost to dorsal crest.

**Biology.**— Recorded from northern reaches of Boreal Forest, south almost to Texas. Available records indicate that larvae inhabit a wide range of stream types, from small to very large, slow to fast and turbulent. Flight season ranges from at least May 12 to August 30 in Canada, with possible peak in June–July.

**Distribution.**— Trans-continental, recorded from Boreal Forest south to Utah, Arkansas, and North Carolina (Map 23). In Canada this species is recorded from south-central British Columbia to Labrador and Nova Scotia.

*Cheumatopsyche vannotei* Gordon

Map 24; Fig. 141–144

*Cheumatopsyche vannotei* Gordon, 1974:138.

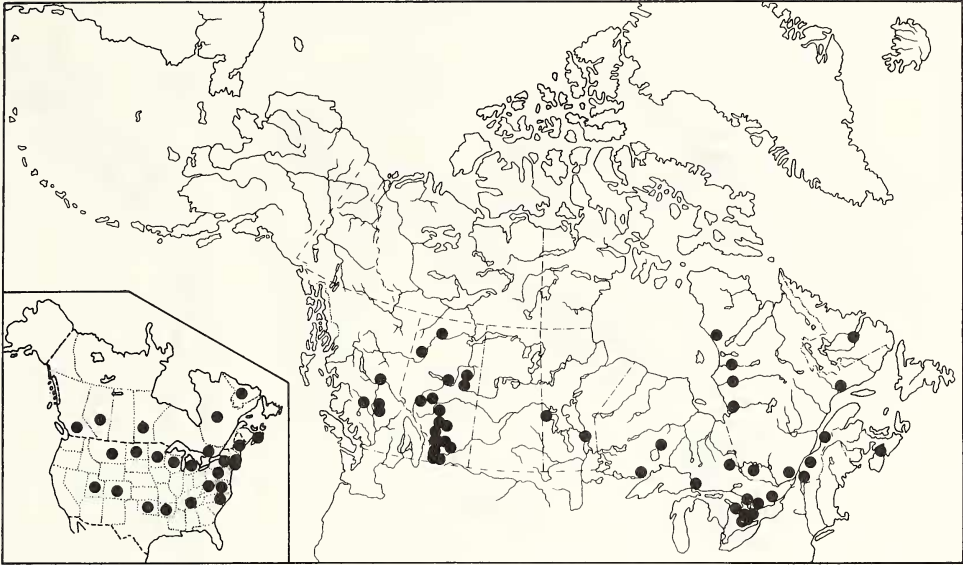
**Description.**— Male fore-wing length 7.02 mm; yellowish brown, evenly irrorate. Hind-wing palely tinted brown. Antennae brown basally, to light yellow-brown distally. Vertex brown, warts slightly paler. Thorax brown, to pale yellowish brown laterally. Legs straw to cream-coloured.

**Genitalia.** Male. (Fig. 141–144). (Specimen from East White Clay Ck, rt. 926, South Chester Co., Pennsylvania, USA – Holotype). Males distinguished by great elongation, posterad, of all parts of genital capsule, in lateral aspect (Fig. 142, 144); by distal lobes of tergum X, in lateral aspect, almost circular, large; by small, knob-like preanal appendage well anterad of distal lobe of tergum X; by distal lobes of tergum X, in posterior aspect (Fig. 141), really quite small, well separated; and by basal article of clasper sufficiently long to extend dorsad of tergum X.

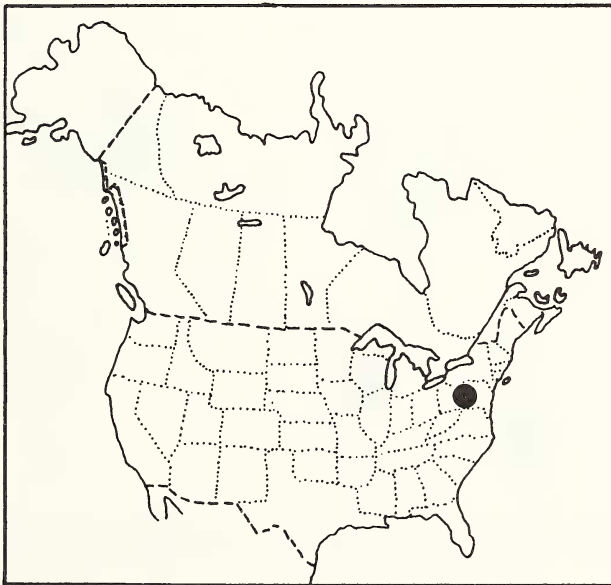
**Genitalia.** Female. Unknown.

**Biology.**— Judging from type locality data it appears that larvae favour at least small streams. Collection date of single known specimen August 3.

**Distribution.**— Presently known only from Pennsylvania, USA (Map 24).



Map 23. Collection localities for *Cheumatopsyche gracilis* (Banks) in Canada, with known distribution in North America by state or province.



Map 24. Known distribution of *Cheumatopsyche vannotei* Gordon in North America, by state.

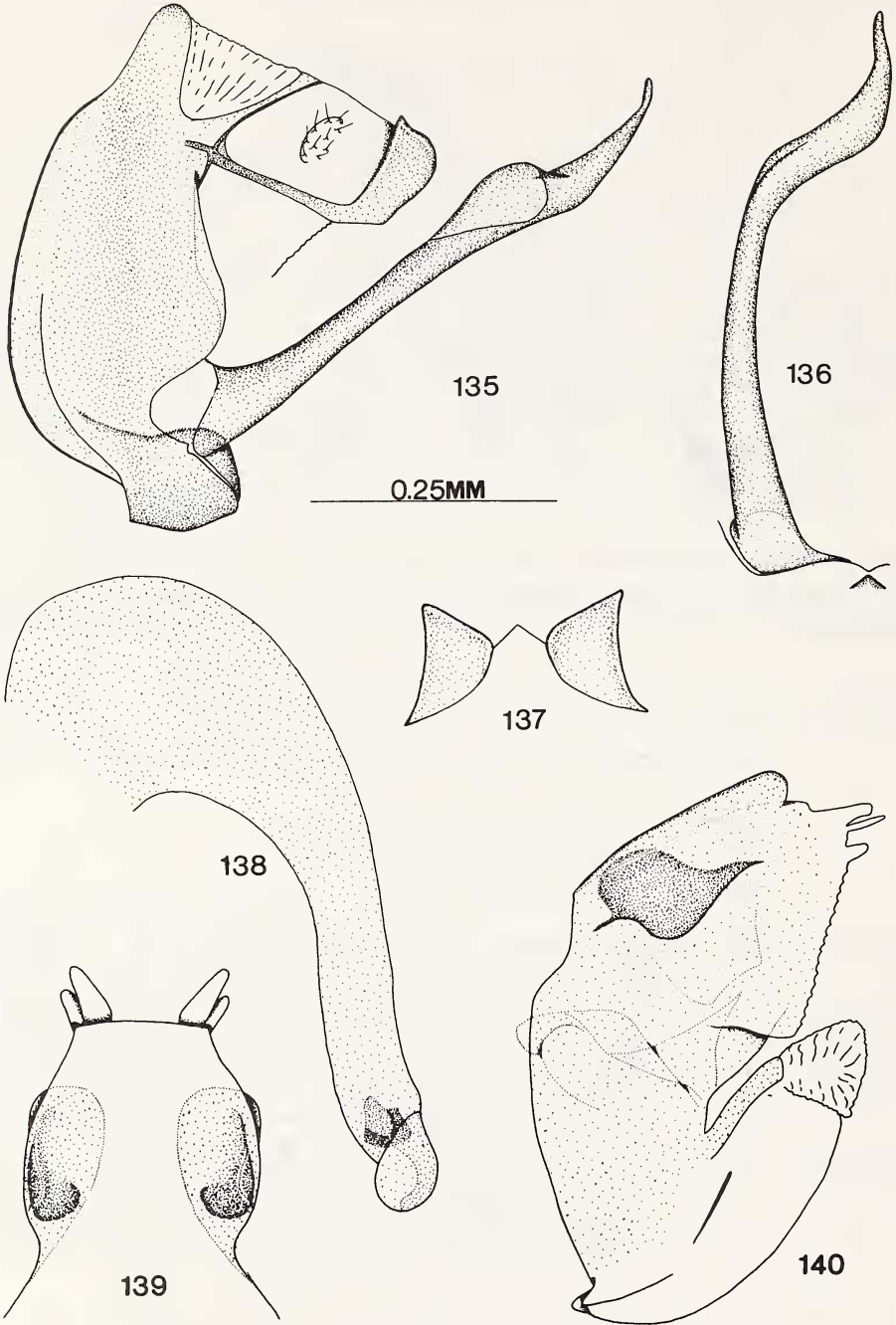


Fig. 135–140, *Cheumatopsyche gracilis* (Banks): 135, genital capsule of male, lateral aspect; 136, left clasper of male, posterior aspect; 137, segment X of male, posterior aspect; 138, aedeagus of male, lateral aspect; 139, genital segments of female, dorsal aspect; 140, genital segments of female, lateral aspect.



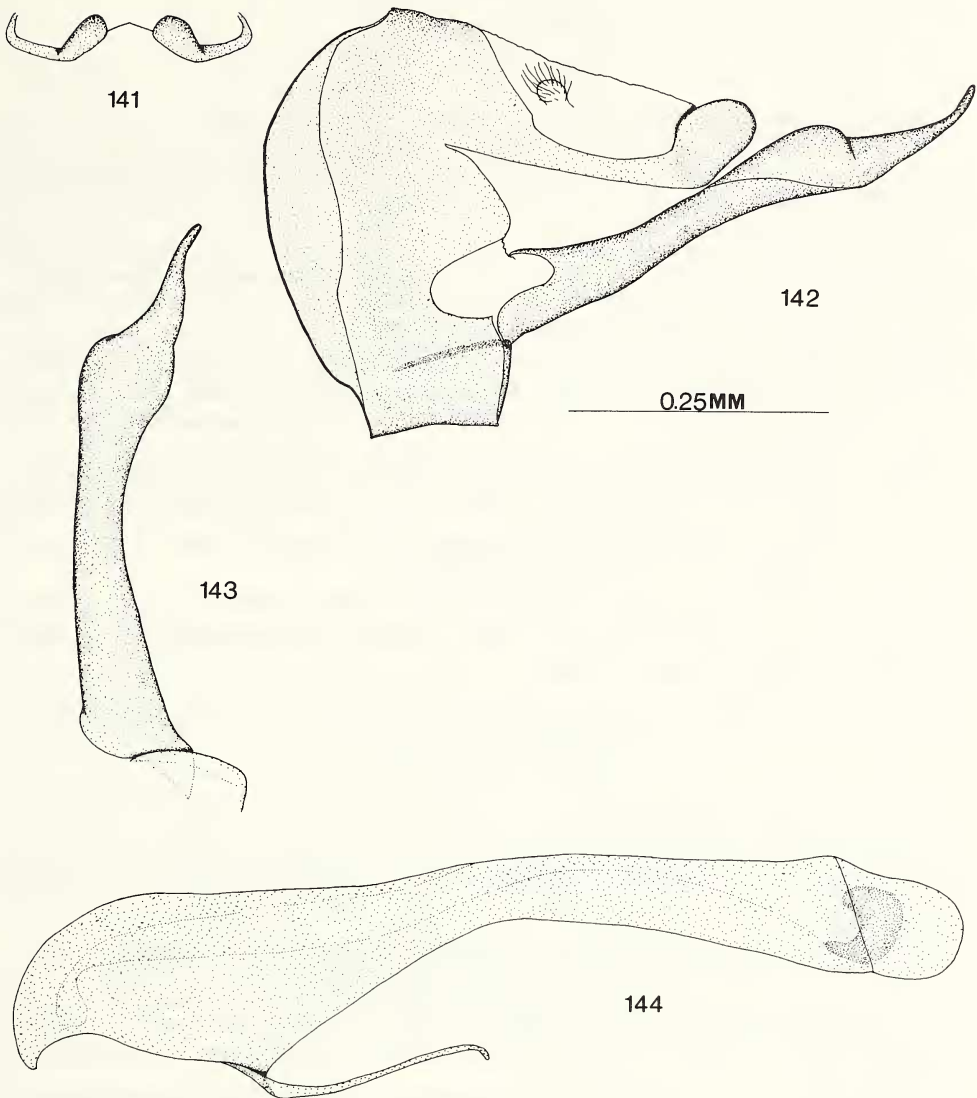


Fig. 141–144, *Cheumatopsyche vannotei* Gordon: 141, segment X of male, posterior aspect; 142, genital capsule of male, lateral aspect; 143, left clasper of male, posterior aspect; 144, aedeagus of male, lateral aspect.

THE *APHANTA* GROUP*Cheumatopsyche oxa* Ross

Map 25; Fig. 145–150

*Cheumatopsyche oxa* Ross, 1938b:155; Denning, 1943:147; Ross, 1944:110; Gordon, 1974:140.

**Description.**— Male fore-wing length 7.1 mm; grey-brown, with uniform faint irroration. Hind-wing pale grey. Antennae brown, without oblique, dark band on any flagellar annulus. Vertex dark chocolate-brown. Spurs pale brown; lateral member of middle leg pairs, and of hind-leg apical pair, notably shorter than mesal companions. Thorax dark chocolate-brown. Legs pale brown to yellow.

**Genitalia.** Male. (Fig. 145–148). (Specimen from creek, Hwy 932, S of Whitecourt, Alberta). Males distinguished by dorsal lobes present on segment IX (Fig. 145); by no gap between tergum X and distal lobes; by distal lobes, in posterior aspect (Fig. 148), long, trapezoidal, except distal end slightly expanded, rounded; by distal lobes virtually contiguous; and by distal article of clasper linear, in posterior aspect (Fig. 146), evenly tapered.

**Genitalia.** Female. (Fig. 149–150). (Specimen from creek, Hwy 932, S of Whitecourt, Alberta). Females distinguished by large clasper receptacle, with inner end curved dorsad, of uniform width, in lateral aspect (Fig. 150); by outer margin of receptacle incised, incision semicircular, directed slightly anterad of dorsal; by inner opening of receptacle evident, of same width as chimney; and by sclerotised strap of vulval scale acute-triangular, with proximal corner connected to base of segment X by thin line.

**Biology.**— Ross (1944) indicates a preference in larvae for small streams, often spring-fed. This species appears to occur in small, local colonies. Illinois flight dates extend from March to October. Generally, Canadian locality records support Ross. Canadian flight records extend from May 17 to September 2, with diffuse peak in July.

**Distribution.**— Roughly triangular when mapped, with angles in British Columbia, Québec, and Georgia (Map 25). The Canadian distribution is from central British Columbia to James Bay, and the Eastern Townships of Québec.

*Cheumatopsyche aphanta* Ross

Map 26; Fig. 151–156

*Cheumatopsyche aphanta* Ross, 1938b:151; Denning, 1943:151; Ross, 1944:111; Gordon, 1974:140.

**Description.**— Male fore-wing length 4.64 mm; red-brown. Hind-wing hyaline with red-brown veins. Antennae pale red-brown; basal five flagellar annuli each with oblique, dark band. Vertex deep red-brown. Spurs straw-coloured; lateral member of front and middle leg pairs much shorter than mesal companions. Thorax deep red-brown, to paler laterally. Legs deep straw-coloured.

**Genitalia.** Male. (Fig. 151–154). (Specimen from Washington Co., Arkansas, USA). Males distinguished by distinct dorsal lobes on segment IX (Fig. 151); by distal lobes of tergum X massive in lateral aspect, rounded, not separated from main body of tergum by gap; by distal article of clasper, in lateral aspect, very much thinner than basal article, with little taper, hooked sharply dorsad at tip; by distal article of clasper, in posterior aspect, with base almost equal in width to basal article, acute-triangular, with slight distal curve; and by distal lobes of tergum X, in posterior aspect (Fig. 153), not very close, spindle-shaped.

**Genitalia.** Female. (Fig. 155–156). (Specimen from Washington Co., Arkansas, USA). Females distinguished by clasper receptacle outer margin produced ventrad, and postero-dorsad, as large ventral lobe and posterior flange respectively, extended posterad of posterior edge of segment X (Fig. 156); by chimney of receptacle inclined slightly posterad of dorsal, without inner opening visible; and by sclerotised strap of vulval scale expanded evenly, gradually, distad, strap curved, not in contact with base of segment X.

**Biology.**— Canadian flight season records extend from June 21 to July 20. Ross (1944) records the species as common adjacent to small streams and brooks, especially those which are permanent and spring-fed. Illinois flight season extends from May to late September.

**Distribution.**— From North Dakota to New York, south to Arkansas in the USA (Map 26). In Canada this species is presently known only from northeastern New Brunswick and the Eastern Townships of Québec.

*Cheumatopsyche halima* Denning

Map 27; Fig. 157–162

*Cheumatopsyche halima* Denning, 1948:400; Gordon, 1974:141.

**Description.**— Male fore-wing length 6.36 mm; uniform grey-brown. Hind-wing tinted pale grey-brown. Antennae pale brown; basal five flagellar annuli each with oblique, darker band. Vertex very dark chocolate, to black-brown. Spurs straw; lateral member of front leg pair much smaller than mesal companion. Thorax very dark chocolate to black-brown, to slightly paler laterally. Legs dark grey-brown.

**Genitalia.** Male. (Fig. 157–160). (Specimen from St Hippolyte, Québec). Males distinguished by lack of dorsal lobes on segment IX (Fig. 157); by very small, v-shaped notch between tergum X and distal lobes; by distal lobes of tergum X, in posterior aspect (Fig. 159), triangular, close to each other; and by distal article of clasper, in posterior aspect (Fig. 158), distinct from basal article, width sharply reduced at junction of the two – distal article curved dorso-laterad.

**Genitalia.** Female. (Fig. 161–162). (Specimen from St Hippolyte, Québec). Females distinguished by clasper receptacle, in lateral aspect (Fig. 162), curved dorso-posterad, with inner opening visible; and by outer margin of receptacle developed postero-ventrad as large, rounded lobe which partly overlaps posterior edge of segment X.

**Biology.**— Massachusetts flight season given by Neves (1979) as June to August. Available Canadian records give a range of June 21 to July 25. Habitat information rare, but larvae are known to inhabit small streams to small rivers.

**Distribution.**— Known from Arkansas northeastern states of USA (Map 27). In Canada this species is recorded from southern Québec and New Brunswick.

*Cheumatopsyche mollala* Ross

Map 28; Fig. 163–168

*Cheumatopsyche mollala* Ross, 1941:81; Ross, 1944:294; Gordon, 1974:142.

**Description.**— Male fore-wing length 6.47 mm; pale grey-brown, faintly irrorate posterad of Cu1 + 2, and along costal margin. Hind-wing uniform grey. Antennae brown; basal seven flagellar annuli each with oblique, dark band. Vertex deep chocolate-brown, warts paler. Spurs yellowish; lateral member of middle leg apical pair, and hind-leg apical pair, shorter than mesal companions; in female, only laterals of middle leg shorter than mesals. Thorax deep chocolate-brown throughout; paler laterally in female; warts paler. Legs straw-coloured.

**Genitalia.** Male. (Fig. 163–166). (Specimen from Lobster Ck, 15 miles SW of Alsea, Benton Co., Oregon, USA). Males distinguished by small, distinct dorsal lobes on segment IX (Fig. 163); by tergum X slightly humped dorsad in lateral aspect; by distal lobes of tergum X dorsally acuminate, triangular, without gap between them and main body of tergum X; by distal lobes, in posterior aspect (Fig. 165), triangular – dorsal angle of each acuminate, directed dorso-laterad; and by distal article of clasper, in posterior aspect (Fig. 164), with basal three quarters stout, directed mesad, and distal quarter thin, acuminate, directed dorsad.

**Genitalia.** Female. (Fig. 167–168). (Specimen from Lobster Ck, 15 miles SW of Alsea, Benton Co., Oregon, USA). Females distinguished by distinctive, bell-shaped clasper receptacle, in lateral aspect (Fig. 168); by inner portion of chimney directed dorsad; and by inner opening of receptacle not visible.

**Biology.**— The sole Canadian record is from May 26. Anderson (1976) gives a flight season for Oregon from late May to early September, with no definable peak. It is unclear what types of flowing waters the larvae may favour.

**Distribution.**— Very spotty (Map 28). Known from Oregon, Idaho, California, and Arkansas in United States, and eastern Ontario in Canada.

*Cheumatopsyche burksi* Ross

Map 29; Fig. 169–175

*Cheumatopsyche burksi* Ross, 1941:83; Ross, 1944:113; Gordon, 1974:142.

**Description.**— Male fore-wing length 7.45 mm; grey-brown; faintly, uniformly irrorate. Antennae yellow-brown; basal six flagellar annuli each with oblique, faintly darker band; five in female. Vertex deep red-brown, warts slightly paler. Spurs brown; lateral member of middle and hind-leg pairs noticeably shorter than mesal companions. Thorax deep red-brown, to yellow-brown laterally. Legs yellow-brown to straw.

*Genitalia*. Male. (Fig. 169–172). (Specimen from Tavares, Lake Co., Florida, USA – Paratype). Males distinguished by distinct dorsal lobes on segment IX (Fig. 169); by small distal lobes of tergum X, in lateral aspect, hardly separable from main body of tergum; by distal article of clasper with wide basal third surmounted by aristate, dorsally curved distal two-thirds, in lateral aspect; by distal article of clasper, in posterior aspect (Fig. 170), much as above, except junction between basal and distal portions more gradual; and by distal lobes of tergum X, in posterior aspect (Fig. 172), well separated, expanded dorsal portion ovoid.

*Genitalia*. Female. (Fig. 173–175). (Specimen from Tavares, Lake Co., Florida, USA – Allotype). Females distinguished by medium-sized clasper receptacle bell-like, but skewed anterad in lateral aspect (Fig. 174); and by posterior edge of each half of sternite VIII irregular (Fig. 175), with small, triangular process slightly higher than mid-point.

*Biology*.— The only flight date available is October 2, in Illinois (Ross, 1944). Nothing more known at present.

*Distribution*.— Presently known only from Illinois to Louisiana and Florida, USA (Map 29).

### *Cheumatopsyche enonis* Ross

Map 30; Fig. 176–181

*Cheumatopsyche enonis* Ross, 1938b:153; Ross, 1944:294; Gordon, 1974:142.

*Cheumatopsyche geolca* Denning, 1952:21; Gordon, 1974:142.

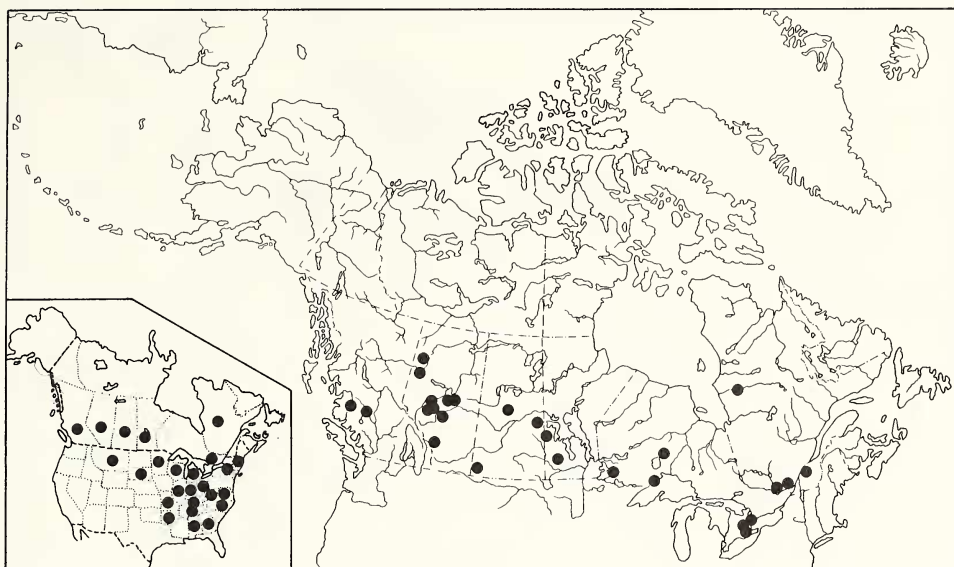
*Description*.— Male fore-wing length 4.99 mm; grey, almost hyaline. Hind-wing hyaline. Antennae brown. Vertex dark brown. Spurs yellow; lateral member of middle leg pairs shorter than mesal companions. Thorax dark red-brown, to paler laterally. Legs yellow.

*Genitalia*. Male. (Fig. 176–179). (Specimen from Dale Ck, Richland, Oregon, USA). Males distinguished by very prominent dorsal lobes of segment IX (Fig. 176); by small, tapered distal lobes of tergum X directed postero-dorsad in lateral aspect; by distal lobes fairly close, trapezoidal in posterior aspect (Fig. 179); and by conical distal article of clasper with meso-ventral spur, in posterior aspect (Fig. 177).

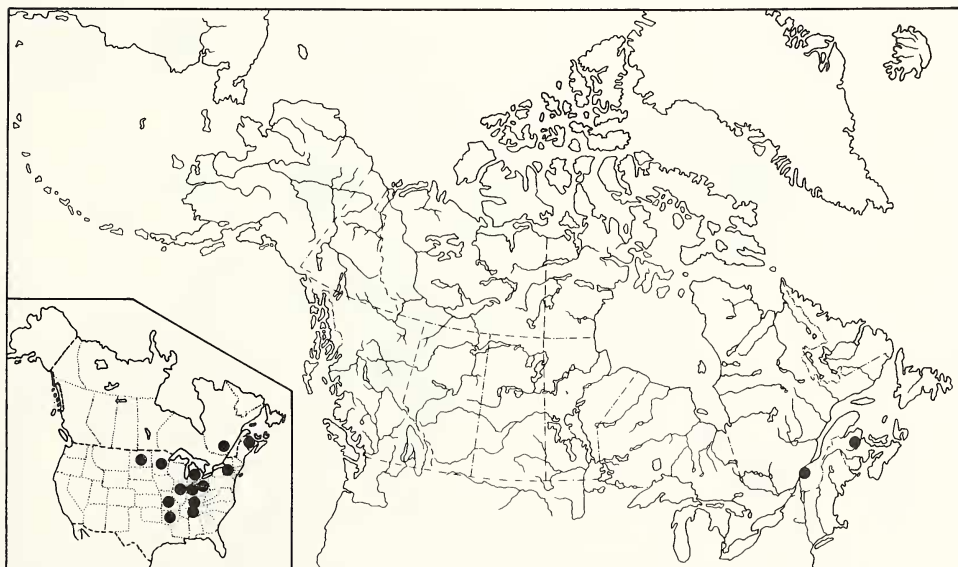
*Genitalia*. Female. (Fig. 180–181). (Specimen from Dale Ck, Richland, Oregon, USA). Females distinguished by clasper receptacle, in lateral aspect (Fig. 181), located dorso-anterad in segment X; by receptacle directed anterad; by receptacle inner opening not visible in lateral aspect [if such an opening exists – not visible in dorsal aspect either (Fig. 180)]; and by vulval scale apparently without sclerotised strap.

*Biology*.— Anderson (1976) has no comment on habitats, but locality names suggest that larvae frequent creeks and, at least, smaller rivers. Oregon flight season is given as June to early September.

*Distribution*.— Recorded from all western cordilleran states of USA, except Washington, California, and Arizona (Map 30).



Map 25. Collection localities for *Cheumatopsyche oxa* Ross in Canada, with known distribution in North America by state or province.



Map 26. Collection localities for *Cheumatopsyche aphanta* Ross in Canada, with known distribution in North America by state or province.



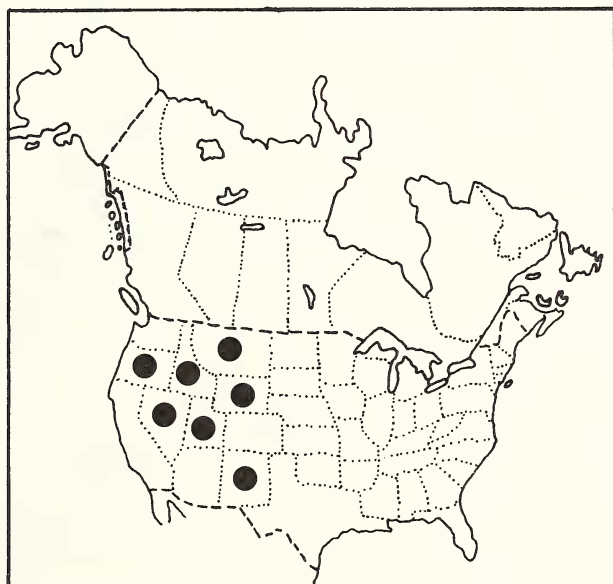
Map 27. Collection localities for *Cheumatopsyche halima* Denning in Canada, with known distribution in North America by state or province.



Map 28. Collection localities for *Cheumatopsyche mollata* Ross in Canada, with known distribution in North America by state or province.



Map 29. Known distribution of *Cheumatopsyche burksi* Ross in North America, by state.



Map 30. Known distribution of *Cheumatopsyche enonis* Ross in North America, by state.

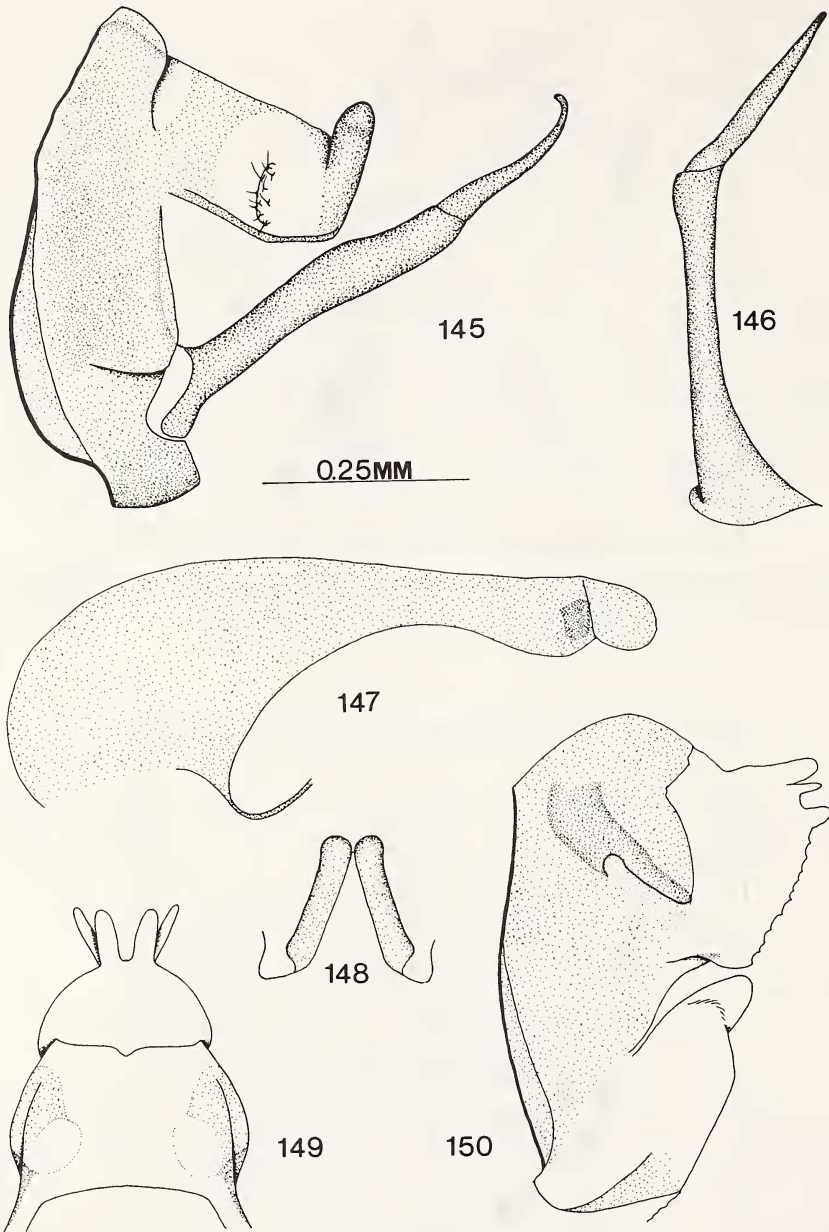


Fig. 145-150, *Cheumatopsyche oxa* Ross: 145, genital capsule of male, lateral aspect; 146, left clasper of male, posterior aspect; 147, aedeagus of male, lateral aspect; 148, segment X of male, posterior aspect; 149, genital segments of female, dorsal aspect; 150, genital segments of female, lateral aspect.



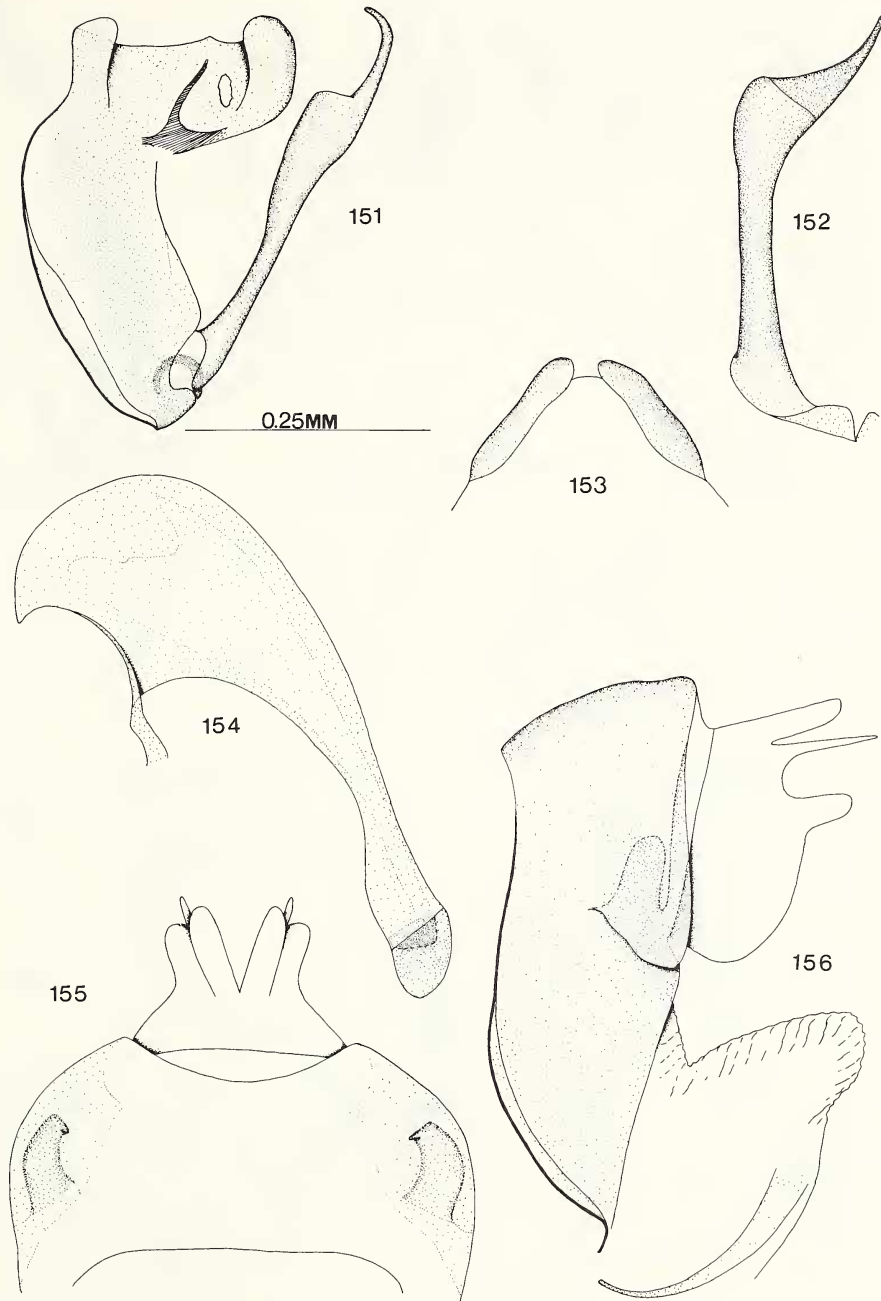


Fig. 151–156, *Cheumatopsyche aphantia* Banks: 151, genital capsule of male, lateral aspect; 152, left clasper of male, posterior aspect; 153, segment X of male, posterior aspect; 154, aedeagus of male, lateral aspect; 155, genital segments of female, dorsal aspect; 156, genital segments of female, lateral aspect.

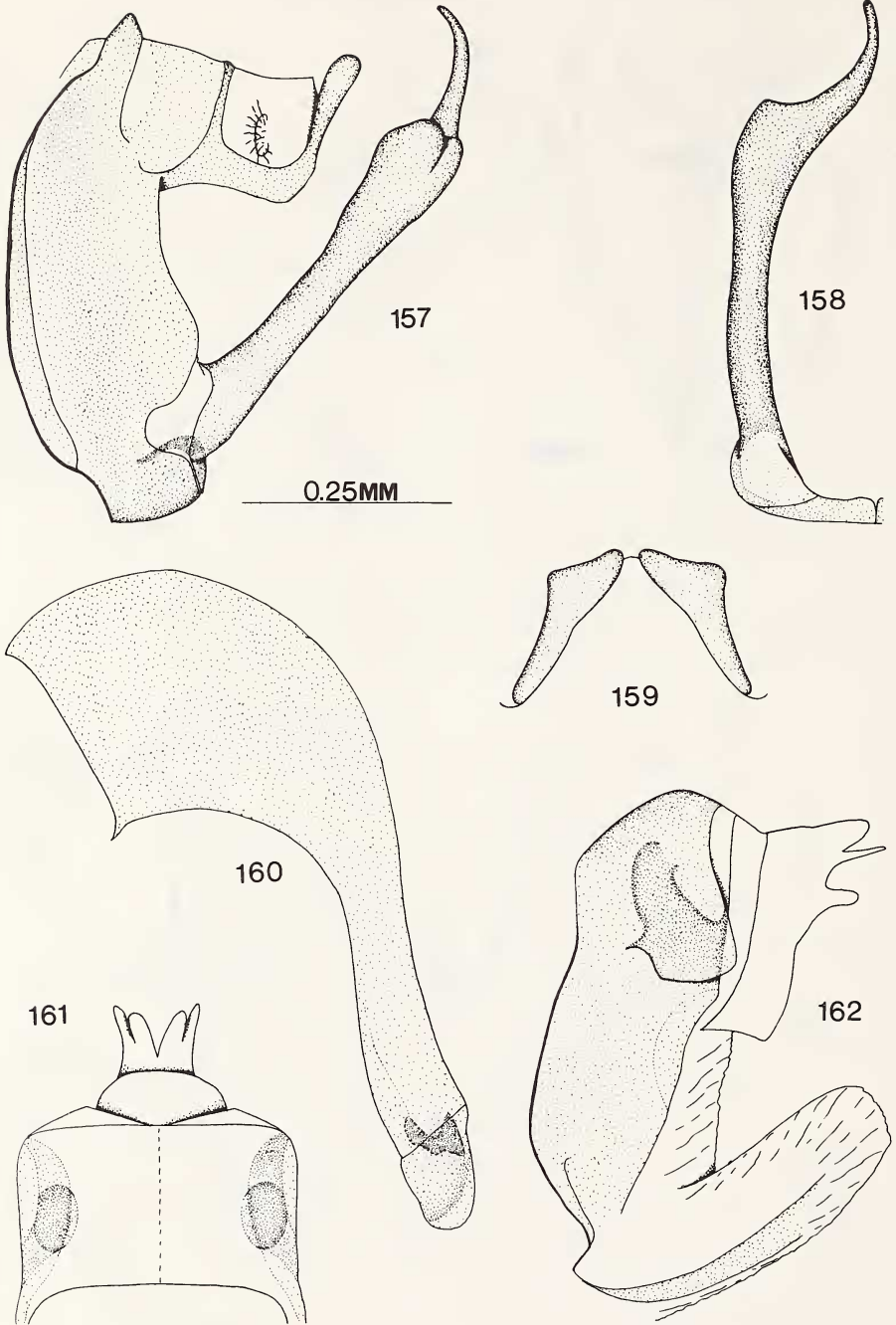


Fig. 157–162, *Cheumatopsyche halima* Denning: 157, genital capsule of male, lateral aspect; 158, left clasper of male, posterior aspect; 159, segment X of male, posterior aspect; 160, aedeagus of male, lateral aspect; 161, genital segments of female, dorsal aspect; 162, genital segments of female, lateral aspect.

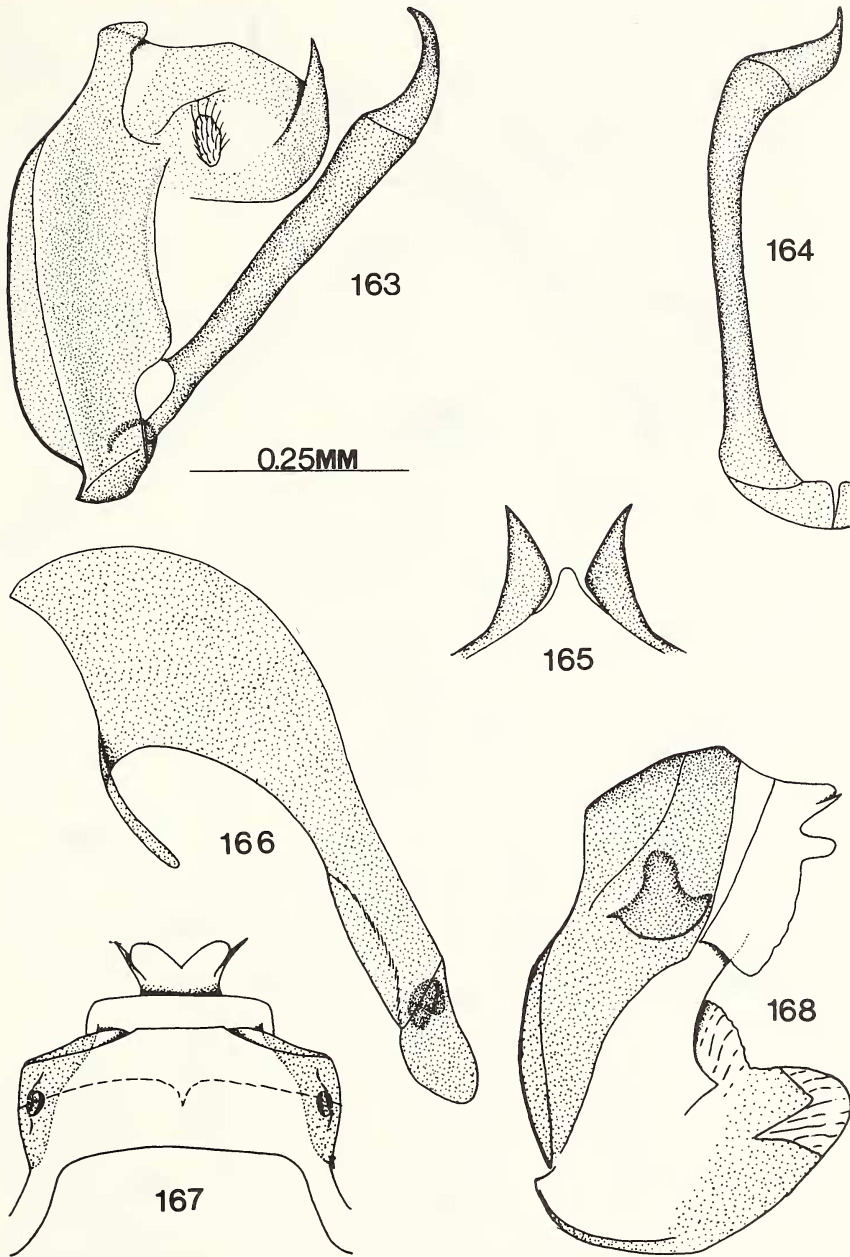


Fig. 163–168, *Cheumatopsyche mollala* Ross: 163, genital capsule of male, lateral aspect; 164, left clasper of male, posterior aspect; 165, segment X of male, posterior aspect; 166, aedeagus of male, lateral aspect; 167, genital segments of female, dorsal aspect; 168, genital segments of female, lateral aspect.

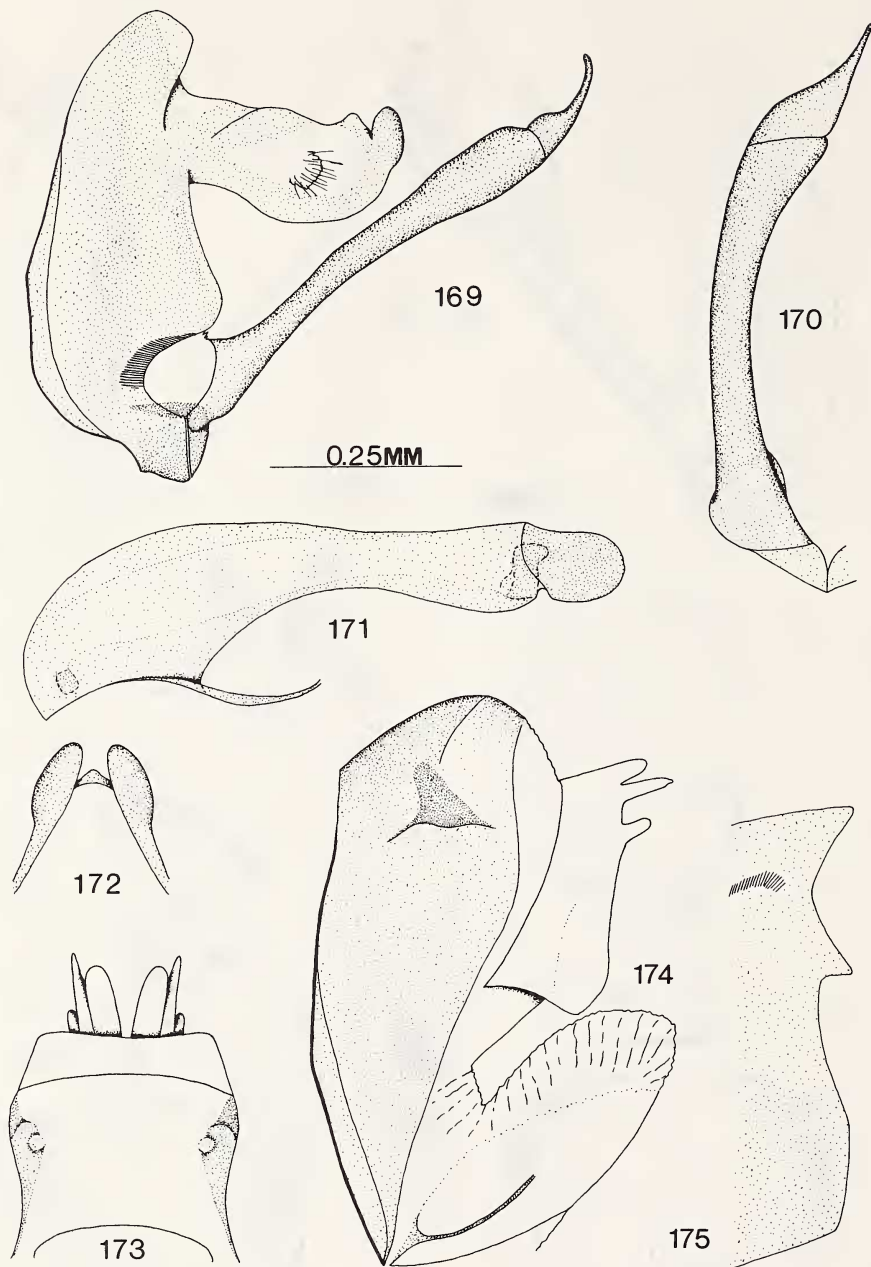


Fig. 169–175, *Cheumatopsyche burksi* Ross: 169, genital capsule of male, lateral aspect; 170, left clasper of male, posterior aspect; 171, aedeagus of male, lateral aspect; 172, segment X of male, posterior aspect; 173, genital segments of female, dorsal aspect; 174, genital segments of female, lateral aspect; 175, left half of sternite VIII of female, lateral aspect.

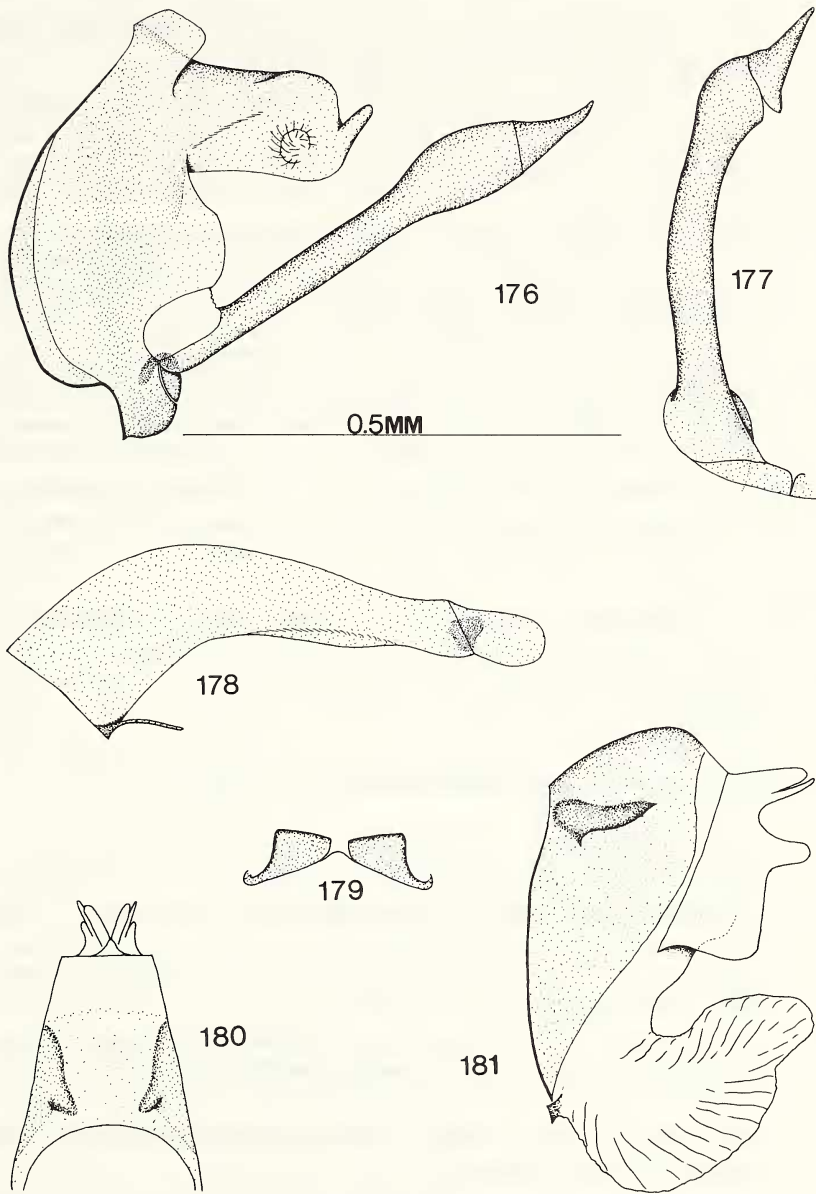


Fig. 176–181, *Cheumatopsyche enonis* Ross: 176, genital capsule of male, lateral aspect; 177, left clasper of male, posterior aspect; 178, aedeagus of male, lateral aspect; 179, segment X of male, posterior aspect; 180, genital segments of female, dorsal aspect; 181, genital segments of female, lateral aspect.

Genus *Hydropsyche* Pictet  
Map 31–71; Fig. 5, 182–462

*Hydropsyche* Pictet, 1834:199; McLachlan, 1878:355, 357; Betten, 1934:183; Milne, 1936:68; Denning, 1943:108; Ross, 1944:86; Ross & Unzicker, 1977:310; Wiggins, 1977:106; Schmid, 1980:58.

*Symphitopsyche* Ulmer, 1907:32; Ross & Unzicker, 1977:304; Schuster & Etnier, 1978:30.

**Description.**— Tarsal claws similar on all three pairs of legs; twisted asymmetrically; overhung by heavy, black hairs. Spur formula 2,4,4. Male sternite V lobe with aperture of large internal gland of two cavities; lobe more or less developed depending on species; gland small, spherical, in female, with only one slightly developed lobe. Cross-veins M3+4-Cu1 and Cu1-Cu2 of fore-wing clearly separated (Fig. 5a). Hind-wing (Fig. 5b) fl petiolate; median cell closed; stems of M and Cu1 parallel, very close.

**Genitalia.** Male. (Fig. 182–186, 304–308, 332–336, etc.). Segment IX with postero-lateral margin developed posterad (Fig. 189), with long setae (not shown). Segment X simple or complex, massive with specifically characteristic lobes (Fig. 182, 183). Claspers (inferior appendages) with stout, conical distal article. Aedeagus curved ventrad basally (Fig. 185, 307, 335); bilobed distally, simple or complex; comprised of sclerotised phallosome with tip cleft in species groups 1 (Fig. 186) and 2 (Fig. 308). No distal cleft in species group 3, but short, erectile endotheca comprised of lobes of varied complexity (Fig. 335, 336); these lobes variously armed with specifically distinct spines and teeth.

**Genitalia.** Female. (Fig. 187–188, 309–310, 337–338, etc.). Tergite VIII notched on mid-line, with slightly recurved lateral angles in some species. Sternite VIII divided apically to two lobes. Segment X with postero-lateral margin produced as blunt, setate lobe (Fig. 187); with clasper receptacle or lateral depression on dorso-lateral face of segment.

**Biology.**— Larvae of *Hydropsyche* spp. inhabit a wide range of flowing waters, from largest rivers to spring-fed streamlets, with specific restriction to some lesser range of types. Larvae of *H. alternans* (Walker) and *H. confusa* (Walker) have also been reported from wave-washed shores of larger lakes. Larvae ingest algae, detritus, and animal matter in seasonally determined proportions.

*Hydropsyche*, the largest genus of the family, is found in all regions but the Neotropical and Antarctica. Wiggins (1977) estimates that about 70 species are now known from North America. Forty-two of these are presented here, most of which are recorded only from east of the western Cordillera.

**Key to known or potential species of *Hydropsyche* Pictet of Canada**

1a	Males (Fig. 182-186) .....	2
1b	Females (Fig. 187-188) .....	42
2a	(1a) Aedeagus entirely sclerotised; without membranous lobes, spines, or teeth distally (Fig. 185, 307) .....	3
2b	Aedeagus with membranous lobes distally (Fig. 335); with or without spines and/or teeth (Fig. 335, 452, 459) .....	24
3a	(2a) Tip of aedeagus tubular in lateral aspect, truncated at right angles to long axis; slightly expanded, rounded in some species (Fig. 307, 314, 321) .....	
	..... species group 2 p. 118 .....	4
3b	Tip of aedeagus, in lateral aspect, bluntly or sharply wedge-shaped, with dorsally flared lateral flanges (Fig. 185, 191, 202, 209) .....	
	..... species group 1 p. 83 .....	7
4a	(3a) Aedeagus, in lateral aspect, with proximal end curved ventrad in semi-circle, directed posterad (Fig. 307) .....	H. betteni Ross, p. 118
4b	Aedeagus, in lateral aspect, with proximal end bent only slightly antero-ventrad (Fig. 314, 321, 328) .....	5
5a	(4b) Distal article of clasper, in posterior aspect, curved smoothly mesad, expanded distally (Fig. 313) .....	H. confusa (Walker), p. 118

5b	Distal article of clasper, in posterior aspect, not curved mesad; narrowed distally (Fig. 320, 327) . . . . .	6
6a (5b)	Distal article of clasper, in lateral aspect, smoothly tapered distad, with rounded tip turned dorsad (Fig. 325) . . . . . <i>H. depravata</i> Hagen, p. 119	
6b	Distal article of clasper, in lateral aspect, irregularly tapered distad, with acuminate tip turned slightly dorsad (Fig. 318) . . . . . <i>H. cuanis</i> Ross, p. 119	
7a (3b)	Cleft in aedeagus tip, in dorsal aspect, simple, v-shaped, without notches or widenings part-way along sides; cleft long or short, wide or narrow (Fig. 192, 197, 203, 217, 224, 231, 245, 252) . . . . .	12
7b	Cleft in aedeagus tip not simple v-shape; variously modified from v-shape (Fig. 186, 210, 238, 280, 294) . . . . .	8
8a (7b)	Distal article of clasper with tip curved dorsad in lateral aspect (Fig. 206, 276, 290) . . . . .	9
8b	Distal article of clasper with tip not curved dorsad in lateral aspect (Fig. 182, 234) . . . . .	11
9a (8a)	Distal article of clasper, in posterior aspect, blunt (Fig. 292). Gap between distal lobes of segment X, in dorsal aspect, wide, approximately v-shaped (Fig. 291) . . . . . <i>H. valanis</i> Ross, p. 90	
9b	Distal article of clasper, in posterior aspect, with disto-lateral process (Fig. 208, 278) . . . . .	10
10a (9b)	Cleft in aedeagus tip wide in dorsal aspect (Fig. 210) . . . . . . . . . . <i>H. bidens</i> Ross, p. 84	
10b	Cleft in aedeagus tip very narrow, with slight widening at inner end (Fig. 280) . . . . . <i>H. scalaris</i> Hagen, p. 89	
11a (8b)	Distal lobes of segment X, in lateral aspect (Fig. 182), directed postero-dorsad, long, narrow . . . . . <i>H. aerata</i> Ross, p. 83	
11b	Distal lobes of segment X directed posterad, short, triangular (Fig. 234) . . . . . . . . . . <i>H. hageni</i> Banks, p. 86	
12a (7a)	Distal article of clasper, in lateral aspect, with tip transversely truncate to greater or lesser degree (Fig. 220, 241, 262, 297) . . . . .	13
12b	Distal article of clasper, in lateral aspect, with disto-ventral corner of tip produced dorsad, or entire tip curved dorsad (Fig. 189, 194, 199, 213, 227, 248, 255, 269, 283) . . . . .	16
13a (12a)	Distal lobes of segment X, in dorsal aspect, separated by broad, flat, v-shaped notch (Fig. 242, 263) . . . . .	14
13b	Distal lobes of segment X, in dorsal aspect, separated by narrow, deep, v- or u-shaped notch (Fig. 221, 297) . . . . .	15
14a (13a)	Distal article of clasper, in lateral aspect, massive, rounded, widened distad (Fig. 241) . . . . . <i>H. occidentalis</i> Banks, p. 87	
14b	Distal article of clasper, in lateral aspect, small, trapezoidal, with slight projection of disto-ventral corner (Fig. 262) . . . . . <i>H. placoda</i> Ross, p. 88	
15a (13b)	Segment X with blade-like process on each lateral surface directed dorsad (Fig. 220) . . . . . <i>H. dicantha</i> Ross, p. 85	
15b	No such process on segment X (Fig. 297) . . . . . <i>H. venularis</i> Banks, p. 90	
16a (12b)	Distal lobes of segment X, in dorsal aspect, separated by v-shaped notch (wide or narrow) (Fig. 190, 195, 200, 249) . . . . .	17

16b	Distal lobes of segment X, in dorsal aspect, separated by notch of varied shapes except 'v' (Fig. 214, 228, 270, 284)	20
17a (16a)	Distal article of clasper with disto-ventral corner, in lateral aspect, produced as pointed lobe (Fig. 194, 248)	18
17b	Distal article of clasper with entire distal end as pointed lobe directed dorsad (Fig. 189, 199)	19
18a (17a)	Tip of aedeagus, in dorsal aspect, cleft deeply, widely (Fig. 197)	<i>H. leonardi</i> Ross, p. 86
18b	Tip of aedeagus, in dorsal aspect, with very shallow cleft continued basad as thin line of closure (Fig. 252)	<i>H. orris</i> Ross, p. 87
19a (17b)	Segment IX with anterior edge of dorsal concavity well posterad of anterior edge of segment (Fig. 189)	<i>H. alvata</i> Denning, p. 83
19b	Segment IX dorsal concavity very close to anterior edge of segment (Fig. 199)	<i>H. arinale</i> Ross, p. 84
20a (16b)	Notch between distal lobes of segment X, in dorsal aspect, narrowed at distal opening (Fig. 270, 284)	21
20b	Notch between distal lobes of segment X not so narrowed, open (Fig. 214, 228, 256)	22
21a (20a)	Notch circular (Fig. 284)	<i>H. simulans</i> Ross, p. 90
21b	Notch elliptical (Fig. 270)	<i>H. rossi</i> Flint, Voshell, & Parker, p. 89
22a (20b)	Notch composite (Fig. 214)	<i>H. californica</i> Banks, p. 84
22b	Notch simple (Fig. 228, 256)	23
23a (22b)	Notch roughly rectangular (Fig. 256). Distal lobes of segment X long, narrowed, directed postero-dorsad in lateral aspect (Fig. 255)	<i>H. phalerata</i> Hagen, p. 88
23b	Notch u-shaped (Fig. 228). Distal lobes of segment X short, triangular in lateral aspect (Fig. 227)	<i>H. frisoni</i> Ross, p. 85
24a (2b)	Distal end of aedeagus with membranous lobes dorsally and ventro-laterally (Fig. 335, 342, 349, 356, 377, 384, 391, 398, 405)	25
24b	Distal end of aedeagus with dorsal membranous lobes only (Fig. 363, 412, 435, 452)	33
25a (24a)	Ventro-lateral lobes of aedeagus reduced to small papillae or simple holes in lateral face of distal extremity of aedeagus (Fig. 377, 384, 391, 398, 405)	subgroup C p. 138
25b	Ventro-lateral lobes long, positioned along side of aedeagus, directed anterad (Fig. 335, 342, 349, 356)	subgroup A p. 126
26a (25a)	Ventro-lateral lobes represented by single lateral hole in sclerotised lateral wall of distal extremity of aedeagus (Fig. 391, 398)	27
26b	Ventro-lateral lobes membranous, very short, in same location as in 26a above	28
27a (26a)	Tooth of dorsal lobe massive, with dentate anterior edge (Fig. 381)	<i>H. morosa</i> Hagen, p. 139
27b	Tooth of dorsal lobe minute, simple (Fig. 398)	<i>H. slossonae</i> Banks, p. 139
28a (26b)	Tooth of dorsal lobe small, directed posterad (Fig. 405)	<i>H. tana</i> Ross, p. 140
28b	Tooth of dorsal lobe large, longer than wide (Fig. 377, 384)	29



- 29a (28b) Distal article of clasper, in lateral aspect, triangular (Fig. 374) . . . . .  
 . . . . . *H. bronta* Ross, p. 138
- 29b Distal article of clasper, in lateral aspect, rather like clenched hand with  
 index finger pointing (Fig. 381) . . . . . *H. cheilonis* Ross, p. 138
- 30a (25b) Ventro-lateral lobe of aedeagus with origin at extreme distal end of  
 aedeagus (Fig. 342, 349) . . . . . 31
- 30b Ventro-lateral lobe of aedeagus with origin ventrad of endotheca (Fig. 335, 353) . . .  
 . . . . . 32
- 31a Ventro-lateral lobe of aedeagus without distal cluster of spines (Fig.  
 342) . . . . . *H. piatrix* Ross, p. 126
- 31b Ventro-lateral lobe of aedeagus with distal cluster of spines (Fig. 349) . . . . .  
 . . . . . *H. vexa* Ross, p. 127
- 32a (30b) Distal lobe of segment X, in lateral aspect (Fig. 332), massive, blunt; in  
 dorsal aspect (Fig. 333) almost linear . . . . . *H. amblis* Ross, p. 126
- 32b Distal lobe of segment X, in lateral aspect (Fig. 353), thin, angled; in  
 dorsal aspect (Fig. 354), distal ends of lobe curved mesad, gap between  
 partly enclosed . . . . . *H. walkeri* Betten & Mosely, p. 127
- 33a (24b) Dorsal lobes membranous only, without teeth or spines (Fig. 452,  
 459) . . . . . subgroup F p. 160 . . . . . 34
- 33b Dorsal lobes membranous, with teeth and/or spines (Fig. 363, 412, 438) . . . . . 35
- 34a (33a) Distal article of clasper, in lateral aspect (Fig. 449), long, tapered from  
 wide base to slender tip . . . . . *H. oslari* Ross, p. 160
- 34b Distal article of clasper, in lateral aspect (Fig. 456), shorter, blunt, not  
 tapered . . . . . *H. ventura* Ross, p. 160
- 35a (33b) Dorsal lobe of aedeagus with one large tooth, and separate cluster of spines  
 (Fig. 439, 445) . . . . . subgroup E p. 156 . . . . . 36
- 35b Dorsal lobe with single tooth only (Fig. 363, 412) . . . . . 37
- 36a (35a) Tooth at distal extremity of lobe; spine cluster laterally (Fig. 438, 439) . . .  
 . . . . . *H. riola* Denning, p. 156
- 36b Spine cluster at distal extremity; tooth laterally (Fig. 445, 446) . . . . .  
 . . . . . *H. sparna* Ross, p. 156
- 37a (35b) Distal tooth of dorsal lobe of aedeagus curved dorsad (Fig. 412, 419, 426,  
 433) . . . . . subgroup D p. 148 . . . . . 38
- 37b Distal tooth curved or directed ventrad (Fig. 363, 370) . . . . .  
 . . . . . subgroup B p. 134 . . . . . 41
- 38a (37a) Distal lobes of segment X, in lateral aspect, curved ventrad (Fig. 409, 416) . . . . 39
- 38b Distal lobes straight, directed postero-dorsad (Fig. 423, 430) . . . . . 40
- 39a (38a) Distal lobes of segment X, in dorsal aspect (Fig. 410), linear . . . . .  
 . . . . . *H. alternans* (Walker), p. 148
- 39b Distal lobes, in dorsal aspect (Fig. 416), curved postero-mesad . . . . .  
 . . . . . *H. centra* Ross, p. 148  
 . . . . . *H. aenigma* Schefter, Wiggins, & Unzicker, p. 148
- 40a (38b) Distal lobes of segment X, in dorsal aspect (Fig. 424), directed  
 postero-laterad . . . . . *H. cockerelli* Banks, p. 149
- 40b Distal lobes curved slightly postero-mesad (Fig. 431) . . . . .  
 . . . . . *H. jewetti* Denning, p. 149

- 41a (37b) Distal tooth of dorsal lobe of aedeagus, in lateral aspect (Fig. 363), with basal quarter wide, distal three-quarters abruptly narrowed to acuminate spine ..... *H. alhedra* Ross, p. 134
- 41b Distal tooth tapered uniformly distad, small, minutely dentate (Fig. 370) ..... *H. bifida* Banks, p. 134
- 42a (1b) Clasper receptacle without evident inner opening, either in lateral aspect (Fig. 204, 218, 239, 246, 274, 309, 323) and/or dorsal aspect (Fig. 205, 219, 240, 275, 310, 324) ..... 43
- 42b Clasper receptacle with clearly evident inner opening in dorsal aspect (Fig. 188, 268, 338, 345), in lateral aspect (Fig. 267, 344) in some species ..... 59
- 43a (42a) Clasper receptacle, in lateral aspect, invagination of lateral wall of segment X, without ventral prolongation of anterior end of outer margin as curved declivity (Fig. 218, 274, 309, 323, 358) ..... 44
- 43b Clasper receptacle, in lateral aspect, curved declivity in dorsal half of segment X, with or without invagination at some point (Fig. 225, 232, 295, 302) ..... 52
- 43c Clasper receptacle simple, elongate groove high on segment X (Fig. 246) ..... *H. occidentalis* Banks, p. 87
- 44a (43a) Clasper receptacle, in lateral aspect, simple, invaginated pouch (Fig. 211, 218, 323, 358) ..... 45
- 44b Clasper receptacle an invaginated pouch, with grooves or lobes within aperture of pouch (Fig. 274, 316, 330) ..... 48
- 45a (44a) Clasper receptacle, in lateral aspect, small, located dorsally (Fig. 218), or anteriorly (Fig. 260) on segment X ..... 46
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- 46a (45a) Clasper receptacle located dorsally on segment X (Fig. 218) ..... *H. californica* Banks, p. 84
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## SPECIES GROUP 1

This group is characterised by aedeagus sclerotised throughout, without membranous lobes, with distal tip wedge-shaped in lateral aspect (e.g., Fig. 185).

*Hydropsyche aerata* Ross

Map 31; Fig. 182–188

*Hydropsyche aerata* Ross, 1938b:144; Ross, 1944:101; Schuster & Etnier, 1978:77.

**Description.**— Male fore-wing length 7.02 mm; light brown; faintly, coarsely irrorate posterad of  $Cu1+2$ . Hind-wing hyaline. Antennae red-brown, no markings in male; allotype female with at least three basal flagellar annuli with dark, oblique bands (remainder of antennae missing). Vertex deep red-brown; narrow in male – eyes very large relative to head; normal in allotype female. Spurs yellow; lateral member of all pairs notably shorter than mesal companions. Thorax uniformly deep red-brown. Legs yellow.

**Genitalia.** Male. (Fig. 182–186). (Specimen from Aroma Park, Kankakee R., Illinois, USA). Males distinguished by distal lobes of segment X approximately rectangular in lateral aspect (Fig. 182), directed postero-dorsad; by distal article of clasper, in lateral aspect, relatively little tapered, without distal hook; by distal cleft of aedeagus, in dorsal aspect (Fig. 186), not v-shaped, widened laterad at mid-point; and by distal article of clasper, in posterior aspect (Fig. 184), parallel-sided, truncate distally.

**Genitalia.** Female. (Fig. 187, 188). (Specimen from Oakwood, Illinois, USA – Allotype). Females distinguished by clasper receptacle, in lateral aspect (Fig. 187), simple, broad, rounded invagination with inner opening not visible, with one groove on receptacle floor; by receptacle, in dorsal aspect (Fig. 188), with ventral portion overlapped by dorsal portion; and by sclerotised strap of vulval scale proximally acuminate, evenly and considerably widened distally.

**Biology.**— Poorly known. Ross gives flight season as May to late August. Apparently a species of large rivers with rapids and gravel bottoms.

**Distribution.**— Not yet known from Canada. In the USA the species is presently only recorded from Illinois, Indiana, and Michigan (Map 31).

*Hydropsyche alvata* Denning

Map 32; Fig. 189–193

*Hydropsyche alvata* Denning, 1949:40; Schuster & Etnier, 1978:125; Flint, Voshell, & Parker, 1979:842.

**Description.**— Male fore-wing length 8.38 mm; pale red-brown, veins darker, faintly irrorate about  $Cu1+2/RS/M$  and distal edge. Hind-wing faintly tinted warm red-brown. Antennae pale red-brown; basal 7 or 8 flagellar annuli each with oblique, dark band. Vertex dark red-brown. Spurs straw-coloured; lateral member of fore- and middle leg pairs much shorter than mesal companions. Thorax dark red-brown, to paler laterally. Legs straw-coloured.

**Genitalia.** Male. (Fig. 189–193). (Specimen from Madison Co., Arkansas, USA). Males distinguished by distal lobes of segment X blunt, triangular in lateral aspect (Fig. 189), short, rounded, separated by u-shaped notch in dorsal aspect (Fig. 190); by distal cleft of aedeagus very narrowly v-shaped in dorsal aspect (Fig. 192); and by distal article of clasper, in lateral aspect (Fig. 189), long, curved slightly dorsad, of even width except for distal taper to upturned tooth.

**Genitalia.** Female. Unknown.

**Biology.**— Virtually nothing known. Denning's (1949) original description provides a range of flight dates from March 3 to July 18.

**Distribution.**— Not yet recorded from Canada. In the USA the species is known from Arkansas to Michigan and Virginia (Map 32).

*Hydropsyche arinale* Ross

Map 33; Fig. 199–205

*Hydropsyche arinale* Ross, 1938b:143; Ross, 1944:104; Schuster & Etnier, 1978:86.

**Description.**— Male fore-wing length 6.32 mm; pale red-brown, with banded pattern in area of anal lobe, with distinct darker bar mid-way along anal edge; faintly irrorate along R1. Hind-wing tinted warm red-brown. Antennae yellow-brown; basal seven flagellar annuli each with oblique, dark band. Vertex pale red-brown. Spurs yellow-brown; lateral member of fore- and middle leg pairs shorter than mesal companions. Thorax deep red-brown, to paler laterally. Legs pale red-brown.

**Genitalia.** Male. (Fig. 199–203). (Specimen from Washington Co., Arkansas, USA). Males distinguished by distal lobes of segment X, in lateral aspect (Fig. 199), short, broad, rounded, separated, in dorsal aspect (Fig. 200), by shallow, wide, v-shaped notch; by distal article of clasper, in lateral aspect, unevenly tapered to dorsally upturned distal hook; and by distal cleft of aedeagus v-shaped in dorsal aspect, with ventral area not notched (Fig. 203).

**Genitalia.** Female. (Fig. 204–205). (Specimen from Washington Co., Arkansas, USA). Females distinguished by clasper receptacle, in lateral aspect (Fig. 204), simple depression on lateral wall of segment X, bounded anteriorly by distinct declivity, with slight invagination at dorsal end of declivity; by clasper receptacle, in dorsal aspect (Fig. 205), simple, large, domed depression in lateral wall of segment X; and by sclerotised strap of vulval scale large, acute-triangular.

**Biology.**— The only available Canadian flight records are July 21–24, in southern Ontario. Ross (1944) gives flight records from April to September. He also indicates that larvae prefer smaller, clear streams of many riffles or rapids. Ross also concludes that this species adheres quite closely to the western fringes of the Oak-Hickory forest.

**Distribution.**— Recorded from Oklahoma and Kansas to southern Ontario (with gaps), with one record from Fraserburg, Ontario (Map 33).

*Hydropsyche bidens* Ross

Map 34; Fig. 206–212

*Hydropsyche bidens* Ross, 1938b:142; Denning, 1943:118; Ross, 1944:107; Schuster & Etnier, 1978:75.

**Description.**— Male fore-wing length 11.08 mm; pale brown, faintly irrorate, with darker areas along Cu1a-1b and A. Hind-wing hyaline. Antennae yellow-brown; basal ten flagellar annuli each with oblique, dark band. Vertex red-brown. Spurs pale brown. Thorax red-brown, to slightly paler laterally. Legs yellow-brown to straw.

**Genitalia.** Male. (Fig. 206–210). (Specimen from Ile Perrot, Québec). Males distinguished by wide, broadly rounded distal lobes of segment X, in lateral aspect (Fig. 206); by these lobes, in dorsal aspect (Fig. 207), separated by deep, narrow cleft with rounded interior expansion; and by distal article of clasper, in lateral aspect, slightly expanded at mid-point, then tapered sharply to dorsally curved, acuminate tooth (tooth visible in posterior aspect (Fig. 208)).

**Genitalia.** Female. (Fig. 211–212). (Specimen from Lac Monroe, Parc Mont Tremblant, Québec). Females distinguished by vulval scale with two sclerites (Fig. 211), one angled; by clasper receptacle high, ventrally tapered invagination, without inner opening visible (Fig. 211, 212); and by clasper receptacle dorsal end associated with thin, dark line originated postero-dorsad on segment X.

**Biology.**— Schuster & Etnier (1978) state that this is a species of larger rivers subject to heavy silt loading. They give flight season dates as April to September, concluding that there is only one generation per year.

**Distribution.**— Recorded from Montana, through Manitoba, to Québec, and south to Texas (Map 34). In Canada known only from southern Manitoba and southwestern Québec.

*Hydropsyche californica* Banks

Map 35; Fig. 213–219

*Hydropsyche californica* Banks, 1899:217; Betten, 1934:193; Milne, 1936:73; Ross, 1938c:16; Denning, 1943:115.*Hydropsyche scalaris* Hagen; Milne, 1936:73 (as synonym of *H. californica*).

**Description.**— Male fore-wing length 9.44 mm; light chocolate-brown, faintly irrorate with larger hyaline areas peripherally. Hind-wing faintly tinted grey-brown. Antennae pale brown; basal seven flagellar annuli each with oblique, dark brown band (eight in female). Vertex very dark purplish brown, warts lighter. Spurs brownish yellow; lateral member

of middle leg pairs, and of hind-leg apical pair, notably shorter than mesal companions. Thorax very dark purplish brown, to dark chocolate-brown laterally.

*Genitalia*. Male. (Fig. 213–217). (Specimen from creek, Hwy 19, 32.5 km S of Kelsay Bay jct., Vancouver Island, British Columbia). Males distinguished by stout basal article of clasper in lateral aspect (Fig. 213); by distal article of clasper, in lateral aspect, offset somewhat posterad, of even width, with disto-ventral angle produced bluntly distad; by clasper, in posterior aspect (Fig. 215), smoothly curved mesad; and especially by distal lobes of tergum X, in dorsal aspect (Fig. 214), composite, with pair of secondary lobes within primary lobes.

*Genitalia*. Female. (Fig. 218–219). (Specimen from creek, Hwy 19, 32.5 km S of Kelsay Bay jct., Vancouver Island, British Columbia). Females distinguished by clasper receptacle small, boomerang-like, set high in lateral wall of segment X, in lateral aspect (Fig. 218); by lack of sclerotised strap on vulval scale; and by cercus thin, appressed to underside of dorsal lobe of segment XI, well separated from ventral lobe.

*Biology*.— Very little known. Two records from Canada available for flight season – one for July 10, the other simply for August. The July 10 material was taken by myself at a lake outlet into a middling-sized woodland creek over sandy boulder bottom.

*Distribution*.— Presently known from the western and northwestern cordilleran United States, and Vancouver Island, with a record from Minnesota (Map 35). In Canada this species is presently known only from two localities on Vancouver Island.

### *Hydropsyche dicantha* Ross

Map 36; Fig. 220–226

*Hydropsyche dicantha* Ross, 1938b:146; Ross, 1944:102; Schuster & Etnier, 1978:80; Flint, Voshell, & Parker, 1979:845.

*Description*.— Male fore-wing length 7.72 mm; overall warm red-brown. Hind-wing very palely tinted reddish brown. Antennae deep red-brown; distal half of each flagellar annulus paler. Vertex red-brown. Spurs yellow-brown. Thorax deep red-brown, to paler laterally. Legs red-brown.

*Genitalia*. Male. (Fig. 220–224). (Specimen from Lac Monroe, Parc Mont Tremblant, Québec). Males distinguished by acuminate, hooked lobes on lateral faces of segment X (from which the species gets its name)(Fig. 220); by distal article of clasper rectangular in lateral aspect; and by large, sigmoid aedeagus (Fig. 223) with distal cleft narrowly v-shaped (Fig. 222).

*Genitalia*. Female. (Fig. 225–226). (Specimen from R. du Diable, Parc Mont Tremblant, Québec). Females distinguished by clasper receptacle, in lateral aspect (Fig. 225), extended across whole lateral wall of segment X, with posterior and anterior ventrally directed arms, comprised mostly of sharp declivity with very small invagination at postero-dorsal angle; by cercus of segment XI large, acute-triangular, directed postero-dorsad along with dorsal and ventral lobes; by cerci and associated lobes all visible in dorsal aspect (Fig. 226); and by sclerotised strap of vulval scale long, slender, widened distally, recurved.

*Biology*.— Schuster & Etnier (1978) indicate that larvae are fairly indiscriminate in choice of stream type, being known from small, cool, riffled streams, to large, warm rivers. Flight season extends from late June to late September. Canadian records are slightly earlier.

*Distribution*.— Presently known from Minnesota to Tennessee, to New Hampshire and southern Québec (Map 36). In Canada, recorded from southern fringes of Canadian Shield in Ontario and Québec, south to United States border.

### *Hydropsyche frisoni* Ross

Map 37; Fig. 227–233

*Hydropsyche frisoni* Ross, 1938b:142; Ross, 1944:105; Schuster & Etnier, 1978:93.

*Description*.— Male fore-wing length 8.03 mm; light grey-brown, faintly irrorate overall. Hind-wing hyaline. Antennae yellow-brown; basal seven flagellar annuli each with oblique, dark band; presence of bands in faded paratype female uncertain. Vertex deep red-brown. Spurs yellow; lateral member of middle leg pairs shorter than mesal companions. Thorax deep red-brown. Legs light red-brown.

*Genitalia*. Male. (Fig. 227–231). (Specimen from Plateau Experimental Stn, Cumberland Co., Tennessee, USA). Males distinguished by distal article of clasper, in lateral aspect (Fig. 227), of uniform width, linear, with distal end tapered, curved dorsad as small median hook; by aedeagus, in lateral aspect (Fig. 230), with narrow base, distal half expanded, robust; by distal cleft of aedeagus narrow, v-shaped (Fig. 231); and by gap between distal lobes of tergum X, in dorsal aspect (Fig. 228) u-shaped.

*Genitalia.* Female. (Fig. 232–233). (Specimen from White R., Shoals, Indiana, USA – Paratype). Females distinguished by clasper receptacle as semi-circular declivity directed anterad, in lateral aspect (Fig. 232), with very slight invagination at dorsal end; and by sclerotised strap of vulval scale thin, dark line.

*Biology.*— Schuster & Etnier (1978) conclude that larvae prefer small, warm-water rivers and are intolerant of habitat alteration. Flight season is given as April through August.

*Distribution.*— Not yet known from Canada. Recorded from Minnesota to Missouri and Ohio in the United States (Map 37).

### *Hydropsyche hageni* Banks

Map 38; Fig. 234–240

*Hydropsyche hageni* Banks, 1905a:14; Milne, 1936:73 (as synonym of *H. scalaris*); Denning, 1943:119; Ross, 1944:103; Schuster & Etnier, 1978:102; Flint, Voshell, & Parker, 1979:847.

*Description.*— Male fore-wing length 11.66 mm; dark grey-brown, faintly irrorate posterad of R1 (distally), with darker areas along veins. Hind-wing tinted grey-brown. Antennae bright pale red-brown; basal nine flagellar annuli each with oblique, dark band. Vertex red-brown. Spurs pale brown; lateral member of fore- and middle leg pairs shorter than mesal companions. Thorax red-brown. Legs pale red-brown.

*Genitalia.* Male. (Fig. 234–238). (Specimen from Clinch R., Hancock Co., Tennessee, USA). Males distinguished by basal article of clasper, in lateral aspect (Fig. 234), linear, of almost uniform width; by distal article of clasper irregular-pentagonal in outline; and by gap between distal lobes of tergum X, in dorsal aspect (Fig. 235), slightly narrower than interior, gap oval.

*Genitalia.* Female. (Fig. 239–240). (Specimen from Cahaba R., Bibb Co., Alabama, USA). Females distinguished by clasper receptacle small, narrow invagination at dorsal end of short declivity on lateral face of segment X (Fig. 239); by vulval scale with two sclerotised straps – one a fine, dark line, other wider, angled; and by ventral portion of clasper receptacle, in dorsal aspect (Fig. 240), overlapped by dorsal portion.

*Biology.*— The few Canadian records give a flight season of May 25 to June 26. Ross (1944) records flight from May to late August. Larvae appear to prefer faster parts of rivers over boulders and/or bedrock.

*Distribution.*— Recorded from Manitoba to Alabama, Virginia, and southeastern Ontario (Map 38). In Canada presently known only from eastern Manitoba, and southeastern Ontario.

### *Hydropsyche leonardi* Ross

Map 39; Fig. 194–198

*Hydropsyche leonardi* Ross, 1938b:145; Ross, 1944:294; Flint, Voshell, & Parker, 1979:851.

*Description.*— Male fore-wing length 9.67 mm; orange-brown, with darker membrane about Cu1 + 2 and patches posterad of that vein. Hind-wing palely tinted light orange-brown. Antennae brown; some flagellar annuli with oblique, dark band, but number uncertain as most of flagellum missing. Vertex dark chocolate-brown. Spurs brown; lateral member of all pairs shorter than mesal companions. Thorax uniformly dark chocolate-brown. Legs light yellow-brown.

*Genitalia.* Male. (Fig. 194–198). (Specimen from Au Sable R., Crawford Co., Michigan, USA – Paratype). Males distinguished by large, splayed distal lobes of aedeagus, in dorsal aspect (Fig. 197); by distal lobes of tergum X separated by small, v-shaped notch, in dorsal aspect (Fig. 195); and by distal article of clasper, in lateral aspect (Fig. 194), robust, almost trapezoidal, with disto-ventral angle produced as small tooth, and with lateral face concave (see also Fig. 198).

*Genitalia.* Female. Unknown.

*Biology.*— Flint, Voshell, & Parker (1979) provide Virginia flight records which range from April 12 to October 20. Available Canadian records are May 20 and 29. The above authors report adult emergence from riffles of clean, fast-flowing larger rivers.

*Distribution.*— Presently known only from Michigan, Virginia, and southeastern Ontario (at Ottawa)(Map 39).



*Hydropsyche occidentalis* Banks

Map 40; Fig. 241–247

*Hydropsyche occidentalis* Banks, 1900:258; Betten, 1934:194; Milne, 1936:69, 71, 73; Ross, 1938c:17; Ross, 1944:294.  
*Hydropsyche novamexicana* Banks, 1904b:110; Milne, 1936:73 (as synonym of *H. occidentalis*).

**Description.**— Male fore-wing length 8.50 mm; pale brownish yellow with scattered darker areas. Antennae yellow; at least basal six flagellar annuli each with oblique, dark band. Vertex pale reddish brown; yellow-brown in female. Spurs straw; lateral member of middle leg preapical pair notably shorter than mesal companion. Thorax pale reddish brown, to yellowish brown laterally. Legs yellow.

**Genitalia.** Male. (Fig. 241–245). (Specimen from Lethbridge, Alberta). Males distinguished by basal article of clasper with irregularly slender basal third; distal two-thirds parallel-sided, much wider in lateral aspect (Fig. 241); by distal article of clasper robust, in lateral aspect; by same article, in posterior aspect (Fig. 243), with disto-dorsal angle projected mesad from behind disto-ventral edge; and by gap between distal lobes of tergum X, in dorsal aspect (Fig. 242), wide, v-shaped, rounded, not angular.

**Genitalia.** Female. (Fig. 246–247). (Specimen from Lethbridge, Alberta). Females distinguished by clasper receptacle located very high on lateral wall of segment X – a simple slit (Fig. 246); by sclerotised strap of vulval scale linear, widened distally, of medium size; and by lobes of segment XI large, stubby, directed slightly postero-ventrad.

**Biology.**— From my records it seems that adults emerge from all manner of flowing waters, from small, weed-filled, plains streamlets to largest rivers, and from turbulent, rocky foothills streams and rivers. Flight season ranges from June 2 to August 19. Simmons *et al.* (1942) record larvae as being so numerous in a Sierra Nevada water conduit as to require shut-down for cleaning.

**Distribution.**— Widespread throughout western Cordillera from Mexico to British Columbia, east to Great Plains (at least in Canada) of Saskatchewan (Map 40). In Canada, recorded from south-central British Columbia to prairies and Boreal Forest of Alberta and Saskatchewan.

*Hydropsyche orris* Ross

Map 41; Fig. 248–254

*Hydropsyche cornuta* Ross, 1938b:141 (preoccupied by Martynov, 1909).

*Hydropsyche orris* Ross, 1938a:121 (new name); Denning, 1943:118; Ross, 1944:105; Schuster & Etnier, 1978:71.

**Description.**— Male fore-wing length 8.74 mm; pale red-brown; veins darker, foci for irroration pattern. Hind-wing tinted grey-brown. Antennae red-brown; basal 8–9 flagellar annuli each with oblique, dark band. Vertex deep red-brown; paler in available female. Spurs red-brown; lateral member of fore- and middle leg pairs much shorter than mesal companions. Thorax deep red-brown, to slightly paler laterally; warm red-brown in female. Legs red-brown, to straw distally.

**Genitalia.** Male. (Fig. 248–252). (Specimen from Washington Co., Arkansas, USA). Males distinguished by distal article of clasper, in lateral aspect (Fig. 248), of uniform width, curved slightly dorsad, with disto-ventral angle produced as acuminate tooth; by gap between distal lobes of tergum X, in dorsal aspect (Fig. 249), not deep, v-shaped; and by distal cleft of aedeagus (Fig. 252) shallow, v-shaped, continued basad by thin line of closure.

**Genitalia.** Female. (Fig. 253–254). (Specimen from Vicksburg, Mississippi, USA). Females distinguished by clasper receptacle small, triangular, in lateral aspect (Fig. 253), dorsally directed invagination of dorsal portion of semi-circular declivity of lateral wall of segment X; by cerci and dorsal lobes of segment XI, only, visible in dorsal aspect (Fig. 254); and by sclerotised strap of vulval scale narrow at each end, irregularly widened in middle.

**Biology.**— Schuster & Etnier (1978) conclude that larvae are adapted to large rivers with high silt loading and high concentration of suspended organic matter. They also conclude that the species is univoltine, with flight season from April to October.

**Distribution.**— Presently known from South Dakota to Texas, Georgia, and Michigan (Map 41). Not yet known from Canada.

*Hydropsyche phalerata* Hagen  
Map 42; Fig. 255–261

*Hydropsyche phalerata* Hagen, 1861:287; Betten, 1934:189; Milne, 1936:73 (as synonym of *H. morosa*); Denning, 1943:113; Ross, 1944:102; Schuster & Etnier, 1978:78; Flint, Voshell, & Parker, 1979:853.

**Description.**— Male fore-wing length 7.72 mm; pale grey-brown, no evident pattern. Hind-wing hyaline, to faintly tinted. Antennae deep red-brown; basal eight flagellar annuli each with oblique, dark band. Vertex deep brown. Spurs yellow-brown; lateral member of middle leg pairs shorter than mesal companions. Thorax deep brown, to mixed deep brown and paler brown laterally. Legs yellow-brown, to straw laterally.

**Genitalia.** Male. (Fig. 255–259). (Specimen from Mississippi R., Hennepin Co., Minnesota, USA). Males distinguished by distal lobes of tergum X narrow, directed postero-dorsad in lateral aspect (Fig. 255), with gap between, in dorsal aspect (Fig. 256); by distal cleft of aedeagus, in dorsal aspect (Fig. 259), v-shaped, narrow, of medium depth; and by distal article of clasper with dorsal edge straight, ventral edge sinuate, with disto-ventral angle slightly, bluntly produced in lateral aspect (Fig. 255).

**Genitalia.** Female. (Fig. 260–261). (Specimen from Mississippi R., Hennepin Co., Minnesota, USA). Females distinguished by clasper receptacle small, triangular, located very close to anterior edge of segment X, in lateral aspect (Fig. 260); by ventral lobe of segment XI well ventrad of cercus and dorsal lobe; and by sclerotised strap of vulval scale thin, dark line deeply bowed ventrad.

**Biology.**— Flint, Voshell, & Parker (1979) give a flight season range of May 25 to September 27, in Virginia. Ross (1944) gives the Illinois range as late April to September. According to Schuster & Etnier (1978) larvae prefer very wide rivers with shallow riffle areas, with silty gravel and small-to-medium-sized rock bottom, with high suspended organic loading, and with warm water conditions in late Spring and early Fall.

**Distribution.**— Though recorded from Kansas, this species is primarily confined east of a line from Minnesota to Florida (Map 42), as far east as Massachusetts and southern Québec. In Canada it is presently known only from southern Québec and southern Ontario.

*Hydropsyche placoda* Ross  
Map 43; Fig. 262–268

*Hydropsyche placoda* Ross, 1941:87; Denning, 1943:115; Ross, 1944:103; Schuster & Etnier, 1978:127.

**Description.**— Male fore-wing length 8.66 mm; tinted translucent brown, with darker colour mostly about R1 and between Cul + 2 to A3. Female rather darker overall. Antennae pale orange-brown; basal eight flagellar annuli each with oblique, dark band. Vertex orange-brown, markedly narrowed due to considerable enlargement of compound eyes; eyes normal in female. Spurs yellow; lateral member of middle leg pairs notably shorter than mesal companions. Spur formula apparently 1,4,4. Thorax orange-brown, to yellow-brown laterally. Legs pale brown to straw.

**Genitalia.** Male. (Fig. 262–266). (Specimen from Pembina R., Sangudo, Alberta). Males distinguished by distal article of clasper, in lateral aspect (Fig. 262), rectangular, with distal edge scalloped; by gap between distal lobes of tergum X v-shaped, wide, shallow in dorsal aspect (Fig. 263); and by distal cleft of aedeagus, in dorsal aspect (Fig. 265), v-shaped, deep, very narrow.

**Genitalia.** Female. (Fig. 267–268). (Specimen from Ile Ste Hélène, St Lawrence R., Montréal, Québec). Females distinguished by clasper receptacle simple, circular pit anterad of long, curved declivity very close to anterior edge of segment X (Fig. 267).

**Biology.**— Flight season in Canada ranges from May 25 to September 5. Little more known at present. The species is recorded from St Lawrence R. at Montréal, where are rapids of a very large river.

**Distribution.**— Presently known from Alberta and Montana east to Illinois, New York State, and Québec (Map 43). In Canada it is known from both Boreal Forest and prairies of the three Prairie Provinces, and from St Lawrence R. valley of Ontario and Québec.

*Hydropsyche rossi* Flint, Voshell, & Parker  
Map 44; Fig. 269–275

*Hydropsyche incommoda* (not Hagen): Ross, 1944:106; Schuster & Etnier, 1978:92.

*Hydropsyche rossi* Flint, Voshell, & Parker, 1979:854.

**Description.**— Male fore-wing length 9.67 mm; grey-brown, irrorate overall. Hind-wing hyaline. Antennae pale brown; basal nine flagellar annuli each with oblique, dark band. Vertex yellow-brown; warts darker in female. Spurs with lateral member of middle leg pairs shorter than mesal companions. Thorax deep red-brown, to deep yellow-brown laterally. Legs yellow. All warts darker in female.

**Genitalia.** Male. (Fig. 269–273). (Specimen from Waterford, Marshall Co., Mississippi, USA – Paratype). Males distinguished by distal article of clasper with ventral edge linear, dorsal edge sinuate, disto-ventral angle with short, curved tooth (Fig. 269); by postero-dorsal corner of distal lobe of tergum X angled (Fig. 269); and by gap between distal lobes, in dorsal aspect (Fig. 270), small, narrower at opening, elliptical in outline.

**Genitalia.** Female. (Fig. 274–275). (Specimen from Waterford, Marshall Co., Mississippi, USA – Paratype). Females distinguished by clasper receptacle, in lateral aspect (Fig. 274), located dorso-anterad on lateral wall of segment X, small, with outer margin anterior end much lower than posterior end, with no visible inner opening, with two curved grooves on floor of receptacle; and by sclerotised strap of vulval scale small, acute-triangular, with thin, dark line from apex to base of segment X – also, small secondary sclerite dorsad of primary.

**Biology.**— Flight season ranges from March 23 to September 25 according to Flint, Voshell, & Parker (1979), with reference to States from Illinois south to Arkansas. If this species is found in Canada the range may be expected to be rather shortened, especially in Spring. Little more known.

**Distribution.**— Not yet known from Canada. Recorded in United States from area bounded by Missouri to Florida, Virginia, and Illinois (Map 44).

*Hydropsyche scalaris* Hagen  
Map 45; Fig. 276–282

*Hydropsyche scalaris* Hagen, 1861:286; Betten, 1934:190; Milne, 1936:69, 72, 73; Denning, 1943:112; Ross, 1944:106; Schuster & Etnier, 1978:87; Flint, Voshell, & Parker, 1979:856.

**Description.**— Male fore-wing length 11.08 mm; pale reddish brown, faintly irrorate, with darker areas along veins – especially Cu1 and A3. Antennae yellow-brown; basal nine flagellar annuli each with oblique, dark band. Vertex yellow-brown. Spurs pale yellow-brown; lateral member of middle leg pairs, and hind-leg apical pair notably shorter than mesal companions. Thorax deep orange-brown, to paler laterally. Legs pale brown to straw.

**Genitalia.** Male. (Fig. 276–280). (Specimen from Ile Ste Hélène, St Lawrence R., Montréal, Québec). Males distinguished by distal article of clasper, in lateral aspect (Fig. 276), much like knife blade; by distal cleft of aedeagus deep, narrow, with widening part-way along length, in dorsal aspect (Fig. 280); and by gap between distal lobes of tergum X, in dorsal aspect (Fig. 277), narrow, slightly widened interiorly.

**Genitalia.** Female. (Fig. 281–282). (Specimen from Ile Ste Hélène, St Lawrence R., Montréal, Québec). Females distinguished by clasper receptacle, in lateral aspect (Fig. 281), with sharp declivity ventrad of anterior end of outer margin of receptacle, with posterior end of margin continued to dorsum of segment X by thin, dark line; by inner opening of receptacle not evident in lateral aspect, inner end of receptacle curved slightly dorso-posterad; and by ventral portion of receptacle, in dorsal aspect (Fig. 282), overlapped by dorsal portion – inner opening visible.

**Biology.**— Canadian flight season records range from June 4 to August 28. In Virginia, Flint, Voshell, & Parker (1979) recorded adults from May 21 to October 20. Schuster & Etnier (1978) have little more to report on this species except to conclude that larvae prefer warmer water streams of various sizes.

**Distribution.**— Recorded from Colorado and New Mexico to Georgia, Maine, and southern Québec (Map 45). In Canada, known primarily from southern Québec and Ontario, but there is one isolated record from Duck Mountain area of Manitoba, which is in the Boreal Forest.

*Hydropsyche simulans* Ross

Map 46; Fig. 283–289

*Hydropsyche simulans* Ross, 1938b:139; Denning, 1943:117; Ross, 1944:104; Schuster & Etnier, 1978:90.

**Description.**— Male fore-wing length 10.37 mm; warm yellowish brown, uniformly irrorate except from distal end of thyridial cell to f1-f5. Antennae pale yellow-brown; basal ten flagellar annuli each with oblique, dark band; basal nine in female. Vertex yellow-brown. Spurs yellow; lateral member of middle and hind-leg pairs notably shorter than mesal companions. Thorax red-brown dorsally except mesal line yellow; laterally yellow-brown. Legs yellow to straw.

**Genitalia.** Male. (Fig. 283–287). (Specimen from Mt Carmel, Illinois, USA – Paratype). Males distinguished by distal lobes of tergum X, in lateral aspect (Fig. 283), square; by these distal lobes, in dorsal aspect (Fig. 284), with gap between circular; and by distal article of clasper like knife blade in lateral aspect.

**Genitalia.** Female. (Fig. 288–289). (Specimen from Washington Co., Arkansas, USA). Females distinguished by outer margin of clasper receptacle, in lateral aspect (Fig. 288), continued ventrad by declivity, dorsad by thin, dark line; by inner end of receptacle acuminate in lateral aspect, directed dorso-posterad; by sclerotised strap of vulval scale thin, very little widened distally; and by ventral area of clasper receptacle, in dorsal aspect (Fig. 289), slightly overlapped by dorsal area.

**Biology.**— Ross (1944) records emergence as April to late September. Schuster & Etnier (1978) conclude that larvae prefer larger rivers (30–60 m width) with boulder and coarse gravel bottom intermixed with silt. They seem to prefer streams with high organic content.

**Distribution.**— Known to occur from Montana south to Texas, east to southern Ontario (Map 46), this species is known in Canada from one locality near Sarnia, Ontario.

*Hydropsyche valanis* Ross

Map 47; Fig. 290–296

*Hydropsyche valanis* Ross, 1938b:144; Ross, 1944:105; Schuster & Etnier, 1978:85.

**Description.**— Male fore-wing length 8.35 mm; warm red-brown, no evident pattern; faintly irrorate in female. Antennae yellow-brown; basal seven flagellar annuli each with oblique, dark band. Vertex dull yellow-brown, narrow; compound eyes large, with dorso-mesal edges slanted anterad in dorsal aspect; vertex and eyes normal in female. Spurs straw; lateral member of middle and hind-leg pairs notably shorter than mesal companions. Thorax uniformly dull red-brown (dull yellow-brown in female). Legs red-brown, to straw distally; yellow-brown to straw in female.

**Genitalia.** Male. (Fig. 290–294). (Specimen from Baker, Illinois, USA). Males distinguished by distal article of clasper, in lateral aspect (Fig. 290), relatively narrow, with tip curved dorsad from entire width of article; by gap between distal lobes of tergum X, in dorsal aspect (Fig. 291), wide, composite, with inner portion u-shaped; and by distal cleft of aedeagus, in dorsal aspect (Fig. 294), complex, with four separate modifications throughout its depth.

**Genitalia.** Female. (Fig. 295–296). (Specimen from Pontiac, Illinois, USA). Females distinguished by clasper receptacle outer margin with distinct tooth close to posterior end of margin, in lateral aspect (Fig. 295); by receptacle directed dorso-anterad, without inner opening; and by only dorsal lobes of segment XI visible in dorsal aspect (Fig. 296).

**Biology.**— Ross (1944) indicates flight season lasts from May to late August. Little more known, but larvae may prefer very large, warm rivers (see Schuster & Etnier, 1978:86).

**Distribution.**— Known from Minnesota to Kentucky and Ohio; not yet recorded from Canada.

*Hydropsyche venularis* Banks

Map 48; Fig. 297–303

*Hydropsyche venularis* Banks, 1914:252; Betten, 1934:524; Milne, 1936:73 (as synonym of *H. scalaris*); Ross, 1944:294; Schuster & Etnier, 1978:96.

**Description.**— Male fore-wing length 9.98 mm; warm red-brown, faintly irrorate distally; veins Cu1+2 and A darker. In female, irrorate between R1 and RS also. Antennae yellow-brown; basal nine flagellar annuli each with oblique, dark band; eight in female. Vertex yellow-brown, narrow, eyes larger than in other species; female normal. Spurs yellow; lateral member of middle leg pairs shorter than mesal companions. Thorax yellow-brown, to red-brown laterally. Legs straw-coloured.

**Genitalia.** Male. (Fig. 297–301). (Specimen from Conasauga R., Bradley Co., Tennessee, USA). Males distinguished by distal article of clasper, in lateral aspect (Fig. 297), with disto-dorsal corner toothed; by distal lobes of tergum X

rounded-triangular in lateral aspect; and by these distal lobes, in dorsal aspect (Fig. 298), separated by flared, v-shaped gap.

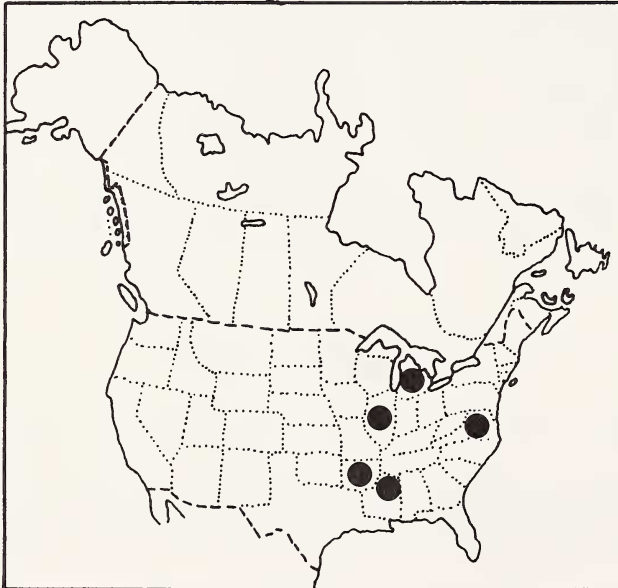
*Genitalia.* Female. (Fig. 302-303). (Specimen from Conasauga R., Bradley Co., Tennessee, USA). Females distinguished by clasper receptacle represented by depression on lateral wall of segment X (Fig. 302); by this depression bounded anteriorly by declivity; and by vulval scale with angled secondary sclerotised strap on side, besides narrow, short, primary strap.

*Biology.*— Larvae occur in medium-sized rivers with large riffle areas; they seem to prefer vegetation-covered rocks. No flight records available.

*Distribution.*— Recorded from area bounded by Wisconsin, Missouri, Georgia, and New York (Map 48). Not yet known from Canada.



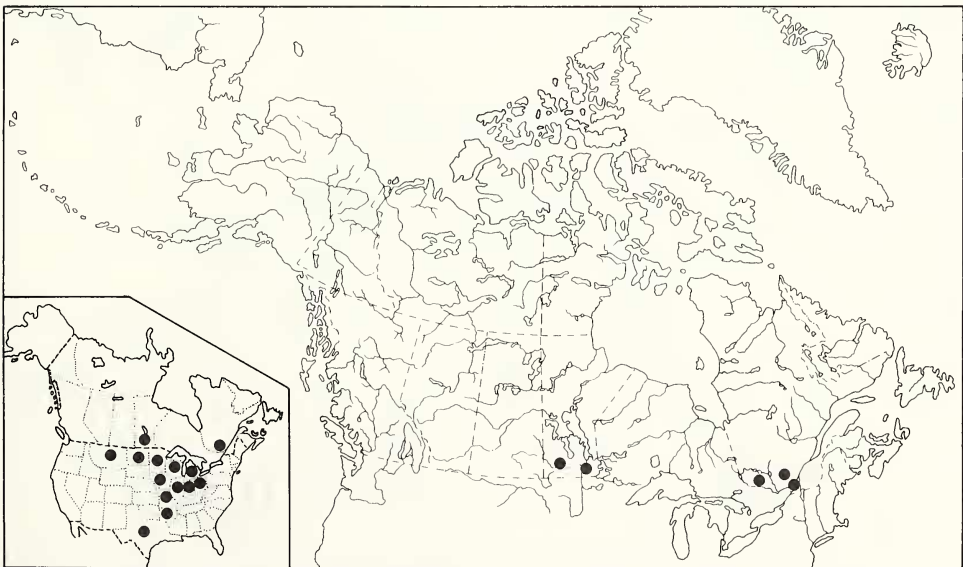
Map 31. Known distribution of *Hydropsyche aerata* Ross in North America, by state.



Map 32. Known distribution of *Hydropsyche alvata* Denning in North America, by state.



Map 33. Collection localities for *Hydropsyche arinale* Ross in Canada, with known distribution in North America by state or province.



Map 34. Collection localities for *Hydropsyche bidens* Ross in Canada, with known distribution in North America by state or province.

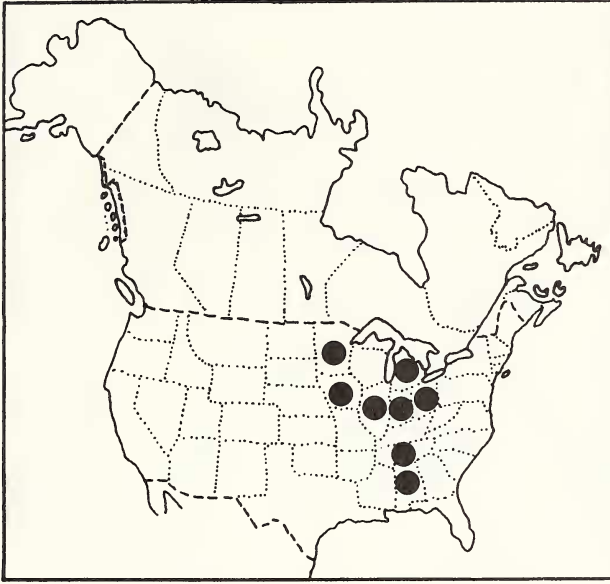


Map 35. Collection localities for *Hydropsyche californica* Banks in Canada, with known distribution in North America by state or province.

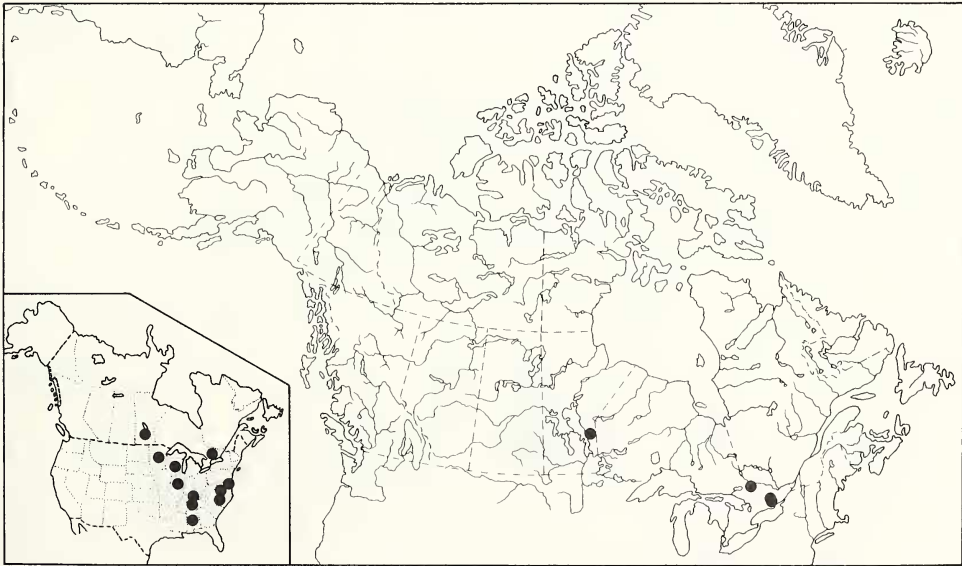


Map 36. Collection localities for *Hydropsyche dicantha* Ross in Canada, with known distribution in North America by state or province.





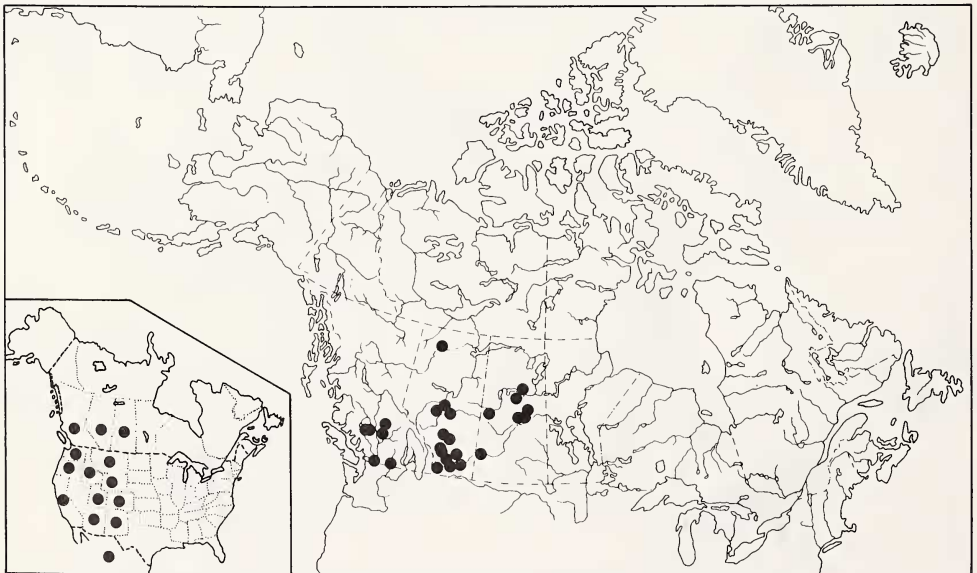
Map 37. Known distribution of *Hydropsyche frisoni* Ross in North America, by state.



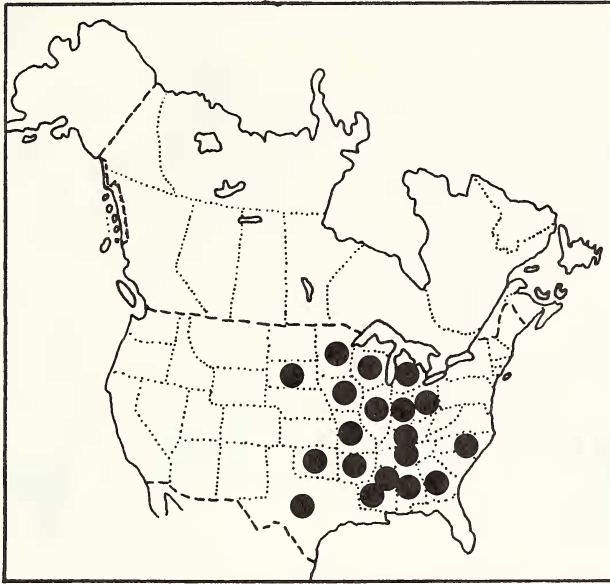
Map 38. Collection localities for *Hydropsyche hageni* Banks in Canada, with known distribution in North America by state or province.



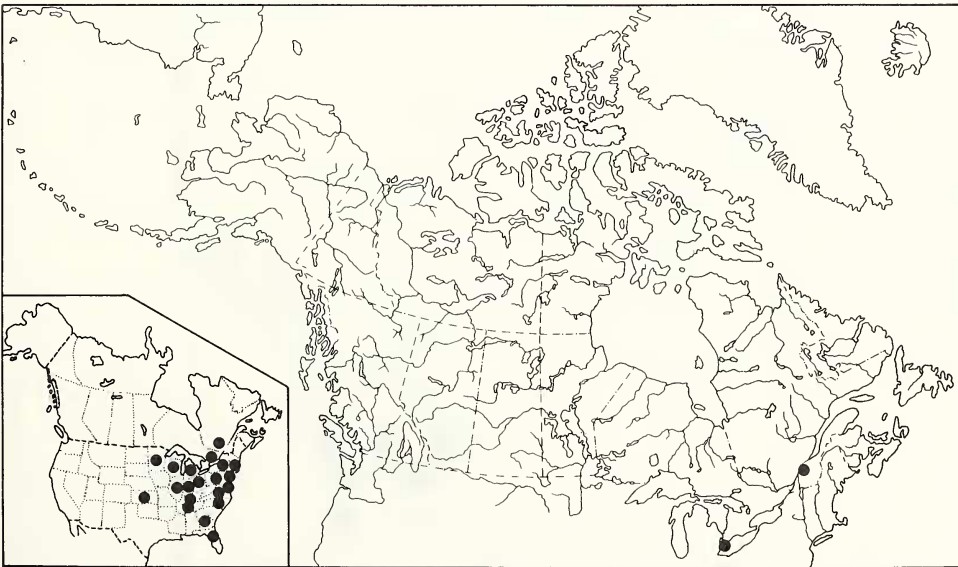
Map 39. Collection localities for *Hydropsyche leonardi* Ross in Canada, with known distribution in North America by state or province.



Map 40. Collection localities for *Hydropsyche occidentalis* Banks in Canada, with known distribution in North America by state or province.



Map 41. Known distribution of *Hydropsyche orris* Ross in North America, by state.



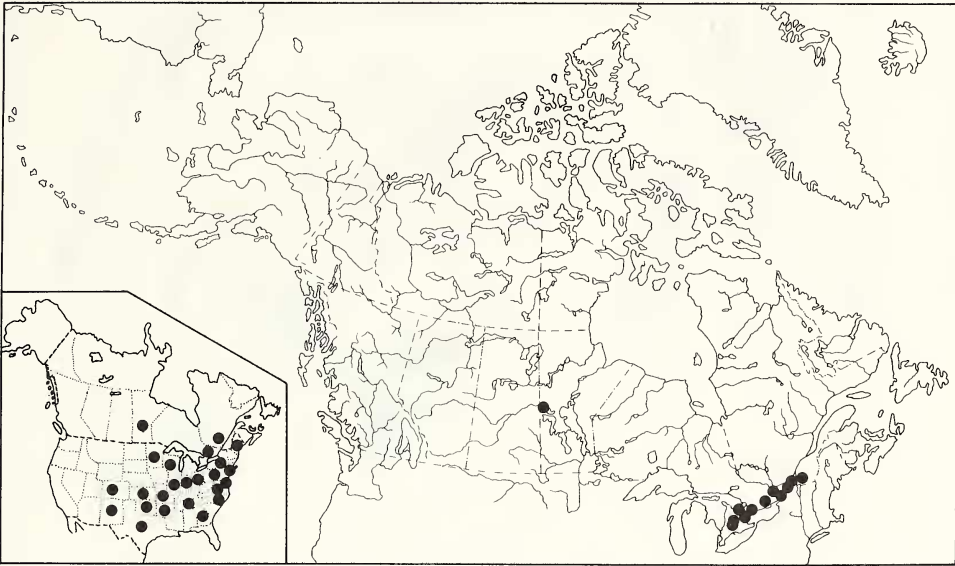
Map 42. Collection localities for *Hydropsyche phalerata* Hagen in Canada, with known distribution in North America by state or province.



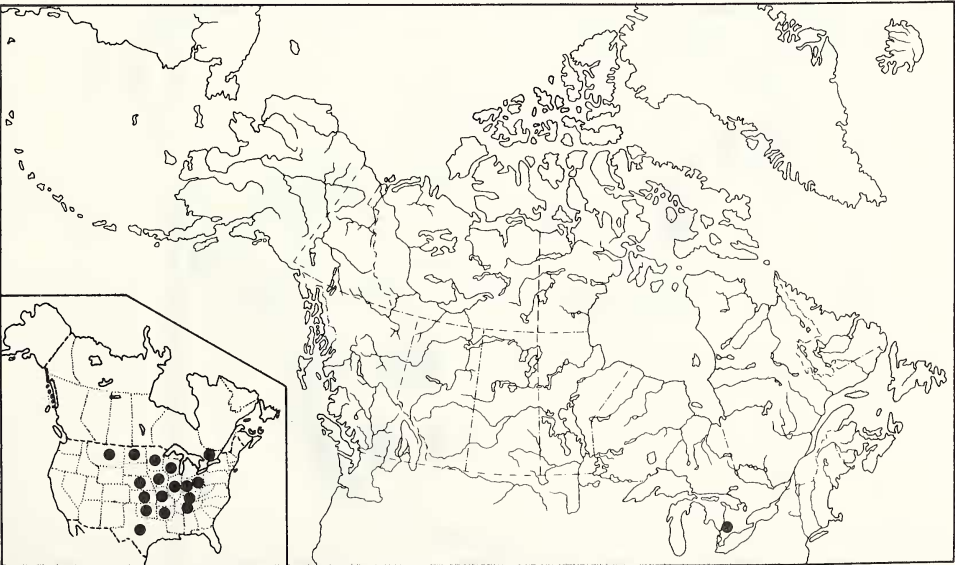
Map 43. Collection localities for *Hydropsyche placoda* Ross in Canada, with known distribution in North America by state or province.



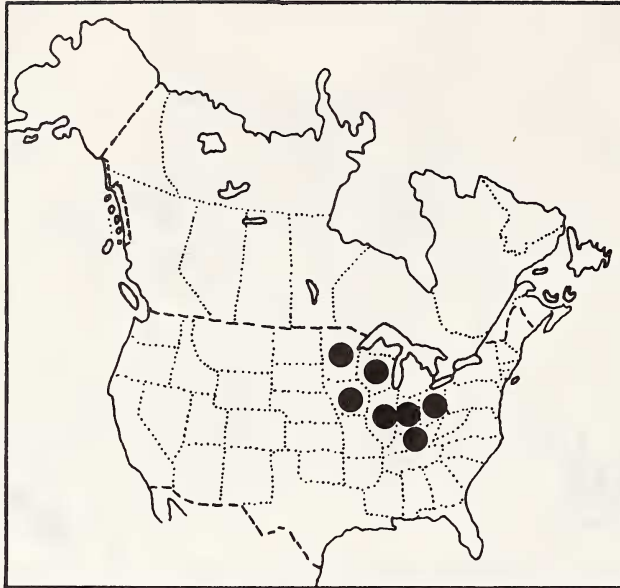
Map 44. Known distribution of *Hydropsyche rossi* in North America, by state.



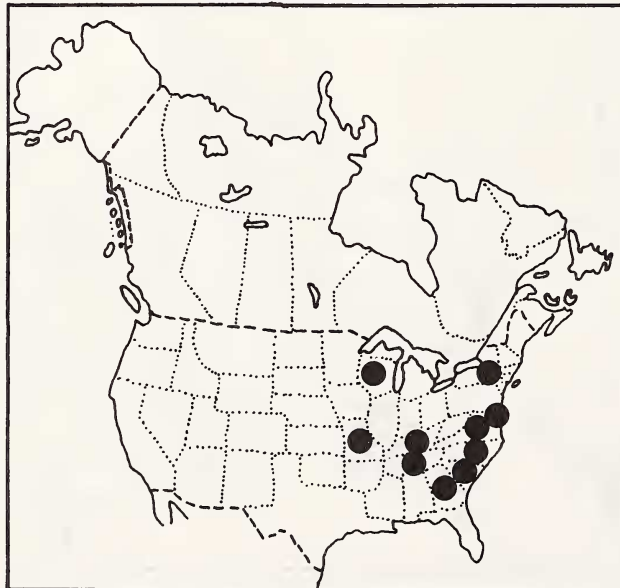
Map 45. Collection localities for *Hydropsyche scalaris* Hagen in Canada, with known distribution in North America by state or province.



Map 46. Collection localities for *Hydropsyche simulans* Ross in Canada, with known distribution in North America by state or province.



Map 47. Known distribution of *Hydropsyche valanis* Ross in North America, by state.



Map 48. Known distribution of *Hydropsyche venularis* Banks in North America, by state.

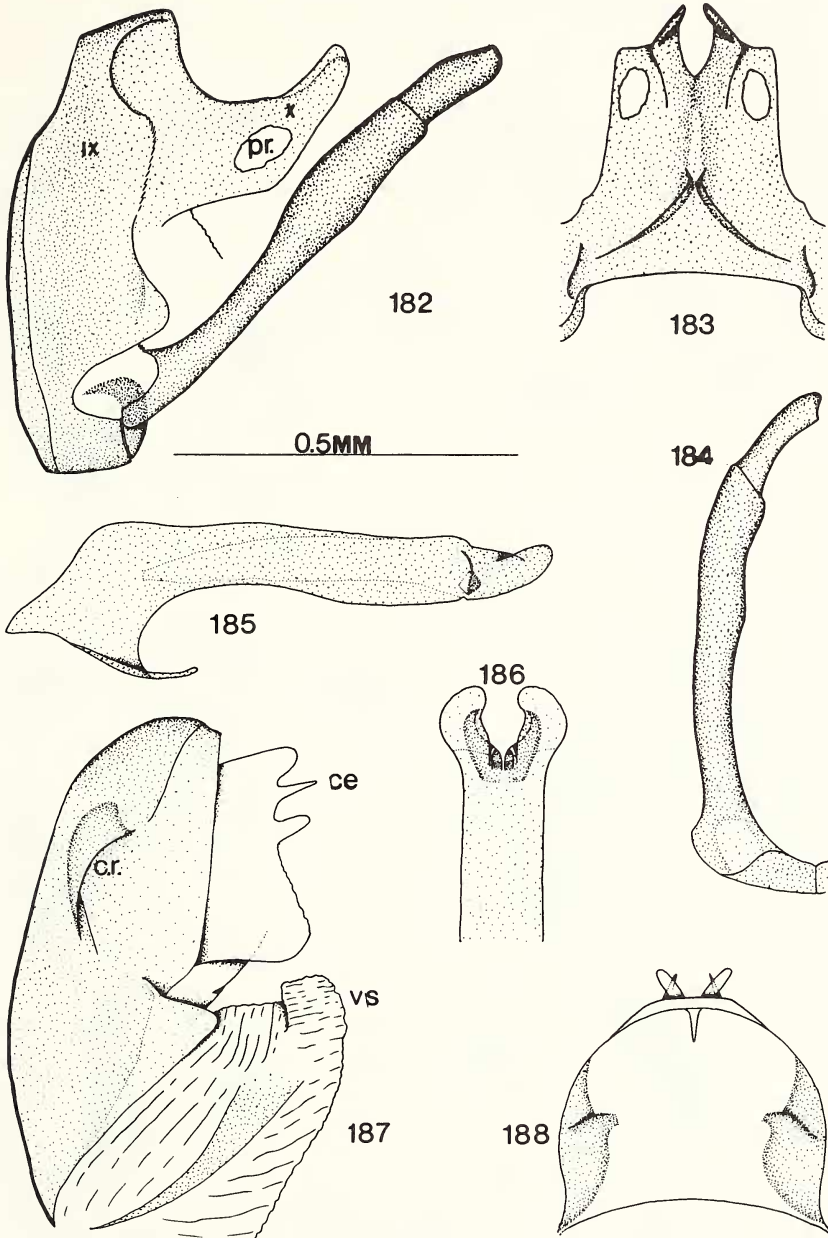


Fig. 182-188, *Hydropsyche aerata* Ross: 182, genital capsule of male, lateral aspect; 183, genital capsule of male, dorsal aspect; 184, left clasper of male, posterior aspect; 185, aedeagus of male, lateral aspect; 186, aedeagus of male, dorsal aspect of tip; 187, genital segments of female, lateral aspect; 188, genital segments of female, dorsal aspect. pr, preanal appendage; cr, clasper receptoracle; ce, cercus, vs, vulval scale.

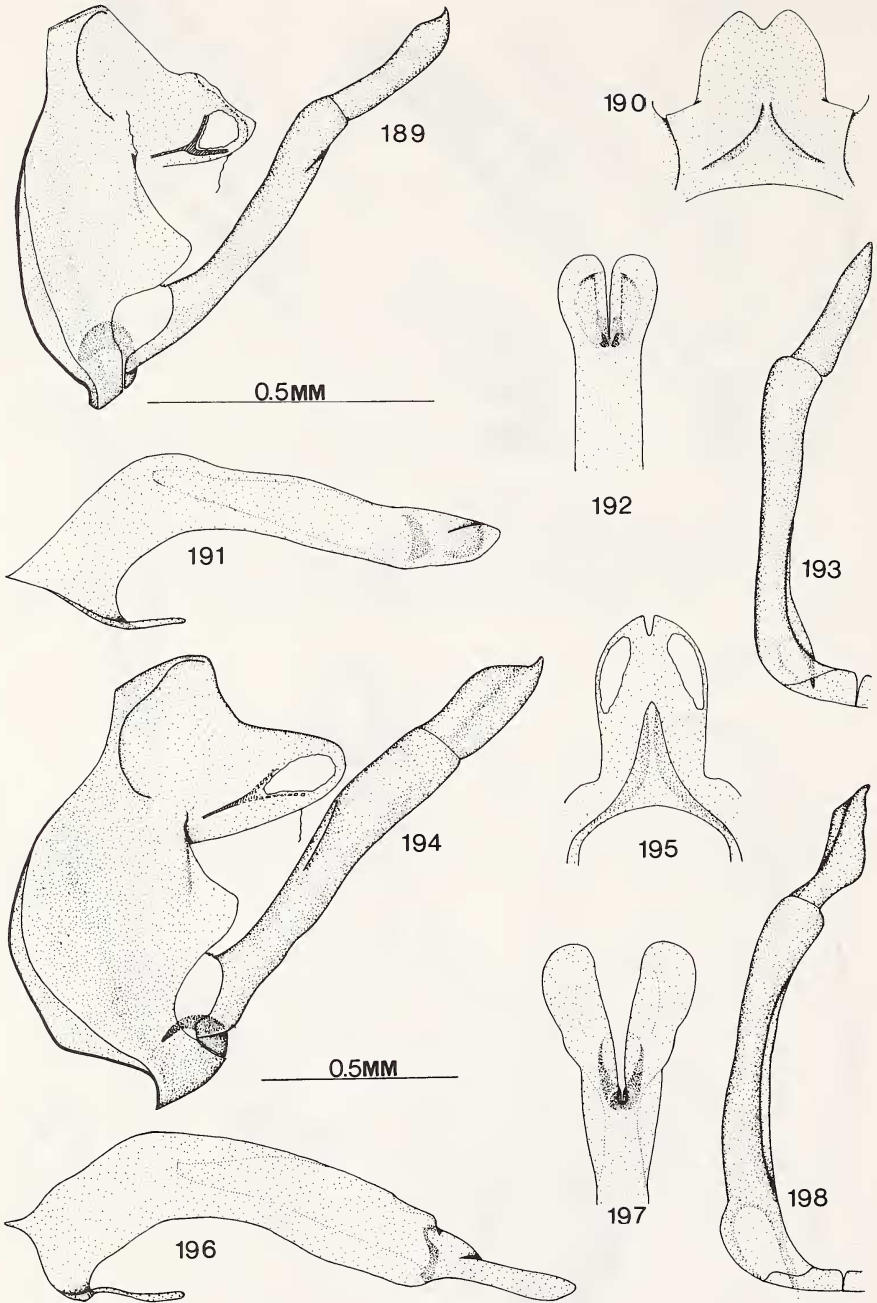


Fig. 189–198. 189–193, *Hydropsyche alvata* Denning: 189, genital capsule of male, lateral aspect; 190, genital capsule of male, dorsal aspect; 191, aedeagus of male, lateral aspect; 192, aedeagus of male, dorsal aspect of tip; 193, left clasper of male, posterior aspect. 194–198, *Hydropsyche leonardi* Ross: 194, genital capsule of male, lateral aspect; 195, genital capsule of male, dorsal aspect; 196, aedeagus of male, lateral aspect; 197, aedeagus of male, dorsal aspect of tip; 198, left clasper of male, posterior aspect.



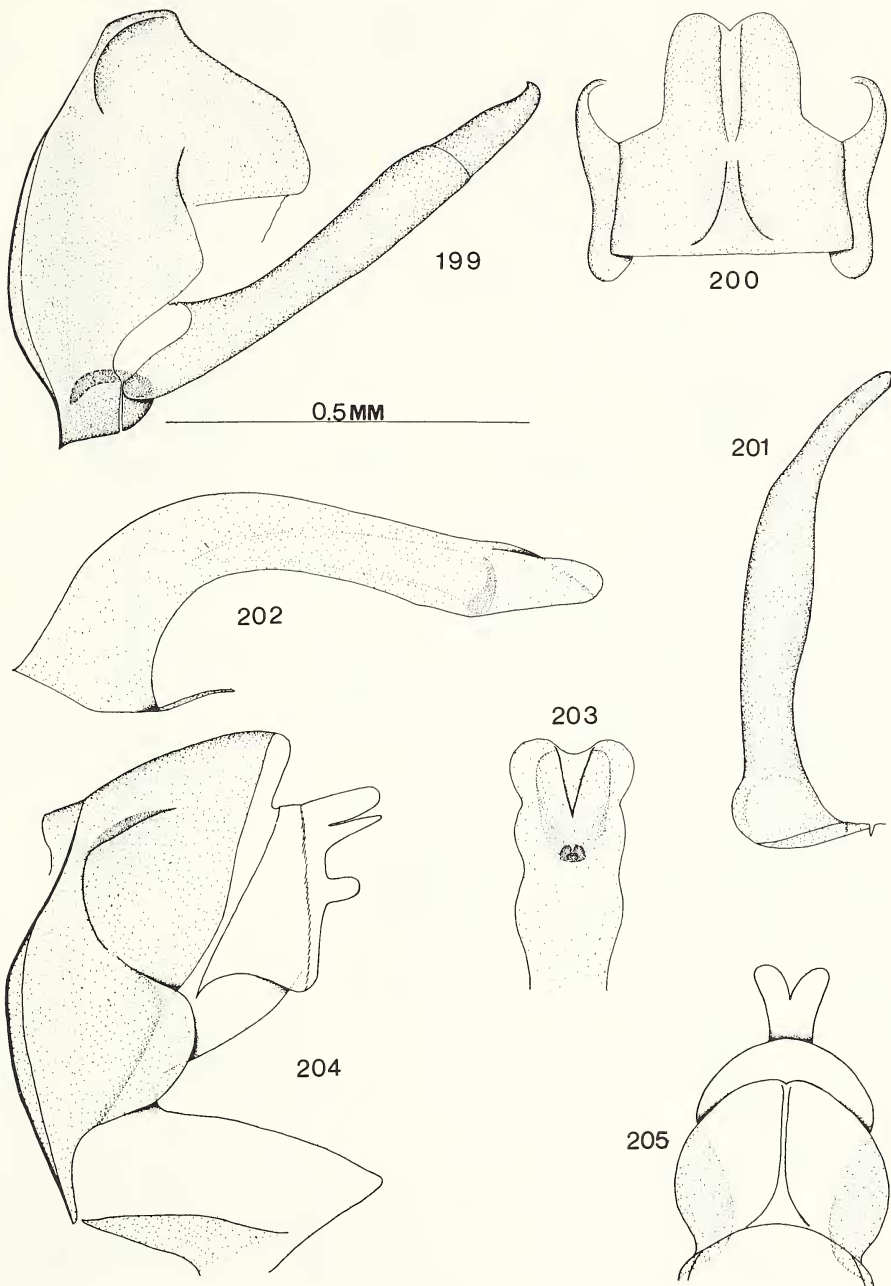


Fig. 199–205, *Hydropsyche arinale* Ross: 199, genital capsule of male, lateral aspect; 200, genital capsule of male, dorsal aspect; 201, left clasper of male, posterior aspect; 202, aedeagus of male, lateral aspect; 203, aedeagus of male, dorsal aspect of tip; 204, genital segments of female, lateral aspect; 205, genital segments of female, dorsal aspect.

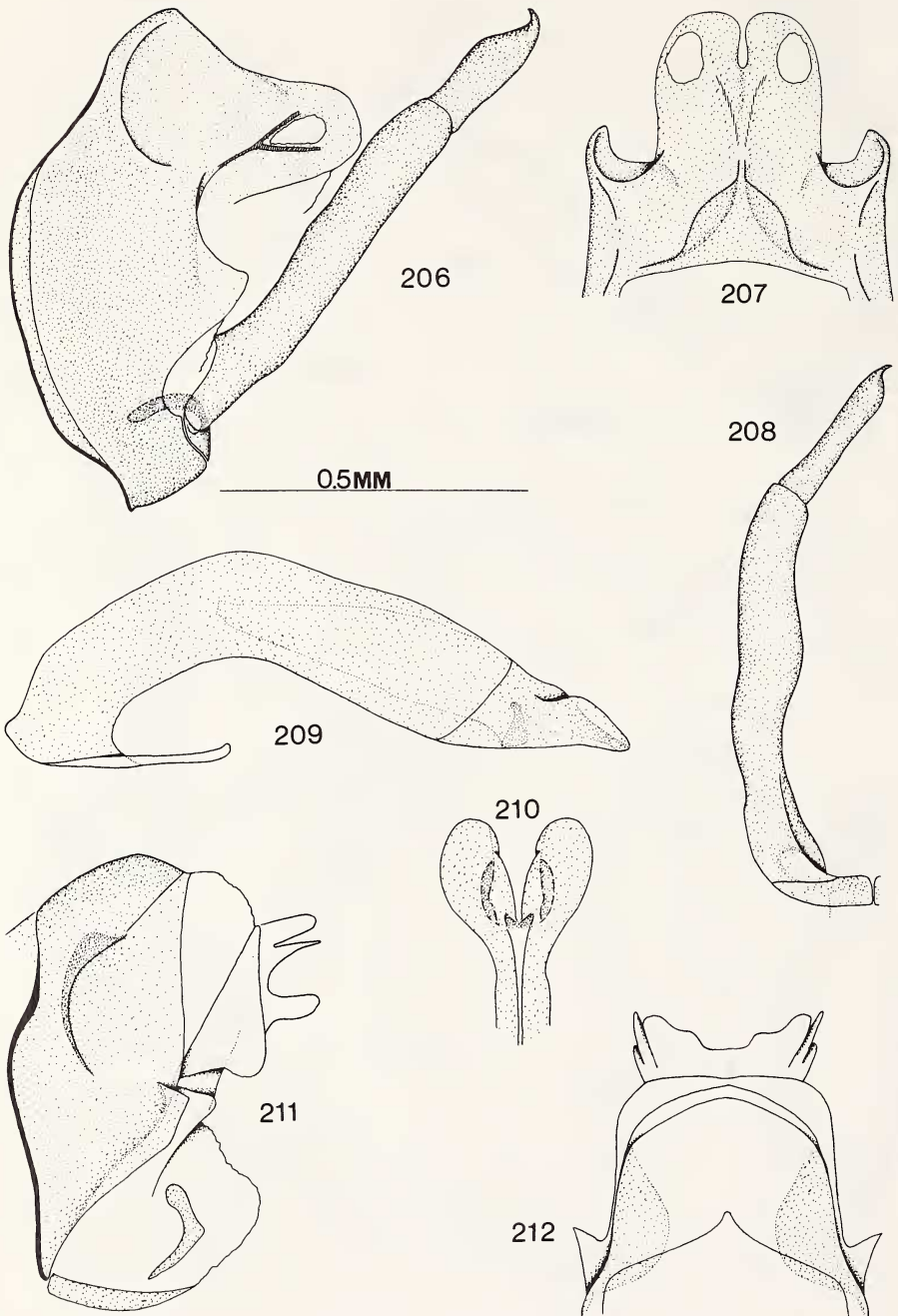


Fig. 206–212, *Hydropsyche bidens* Ross: 206, genital capsule of male, lateral aspect; 207, genital capsule of male, dorsal aspect; 208, left clasper of male, posterior aspect; 209, aedeagus of male, lateral aspect; 210, aedeagus of male, dorsal aspect of tip; 211, genital segments of female, lateral aspect; 212, genital segments of female, dorsal aspect.

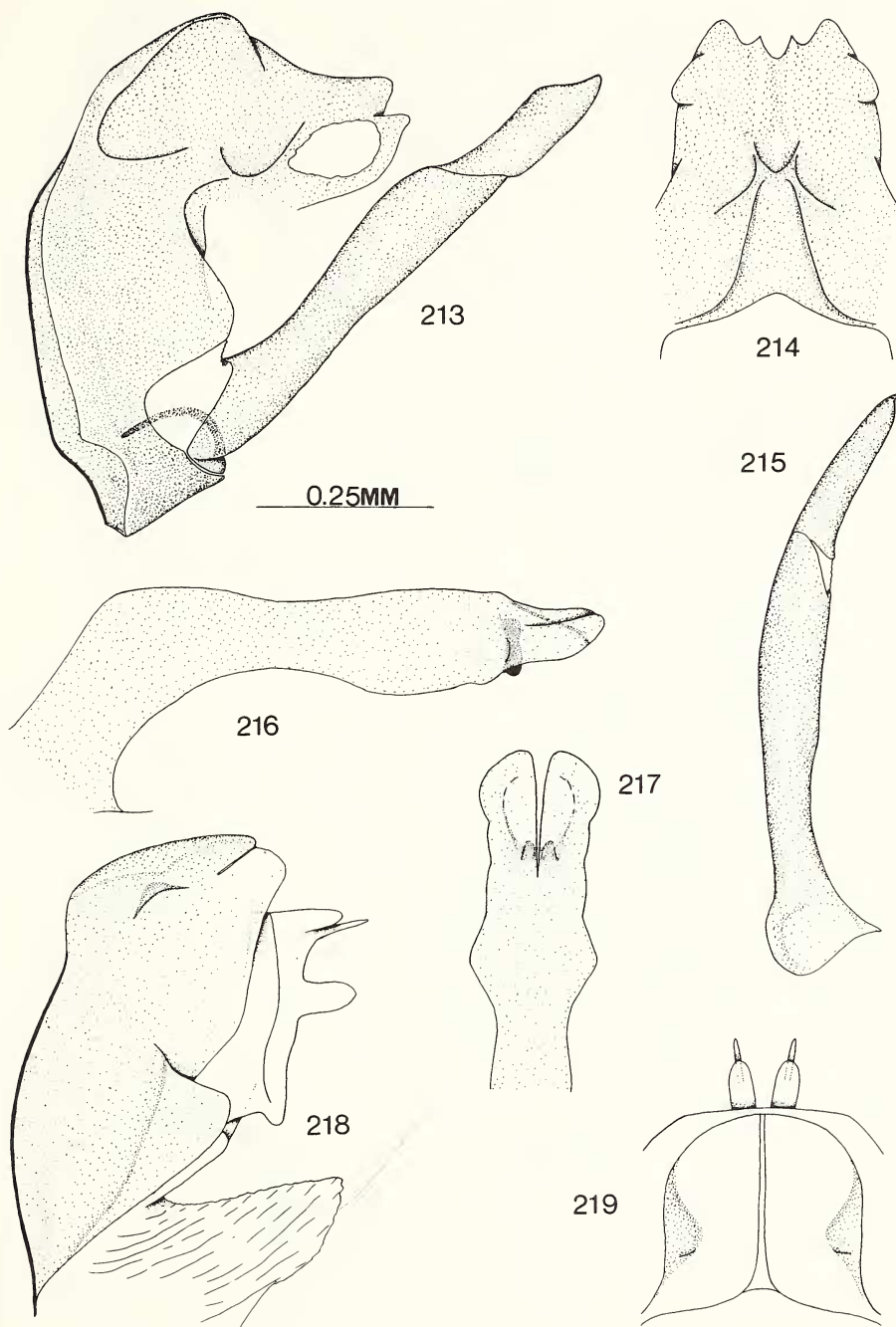


Fig. 213–219, *Hydropsyche californica* Banks: 213, genital capsule of male, lateral aspect; 214, genital capsule of male, dorsal aspect; 215, left clasper of male, posterior aspect; 216, aedeagus of male, lateral aspect; 217, aedeagus of male, dorsal aspect of tip; 218, genital segments of female, lateral aspect; 219, genital segments of female, dorsal aspect.

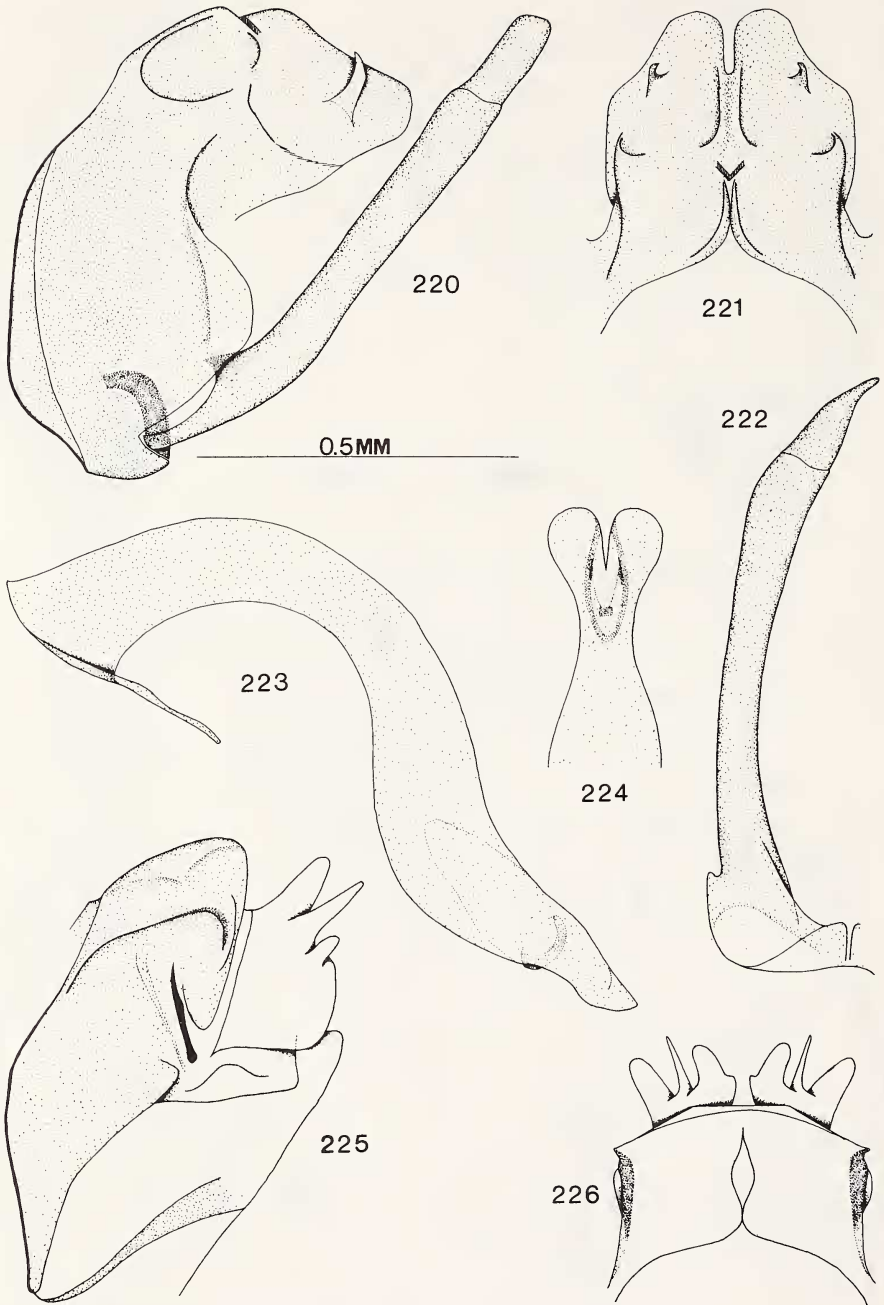


Fig. 220–226, *Hydropsyche dicantha* Ross: 220, genital capsule of male, lateral aspect; 221, genital capsule of male, dorsal aspect; 222, left clasper of male, posterior aspect; 223, aedeagus of male, lateral aspect; 224, aedeagus of male, dorsal aspect of tip; 225, genital segments of female, lateral aspect; 226, genital segments of female, dorsal aspect.

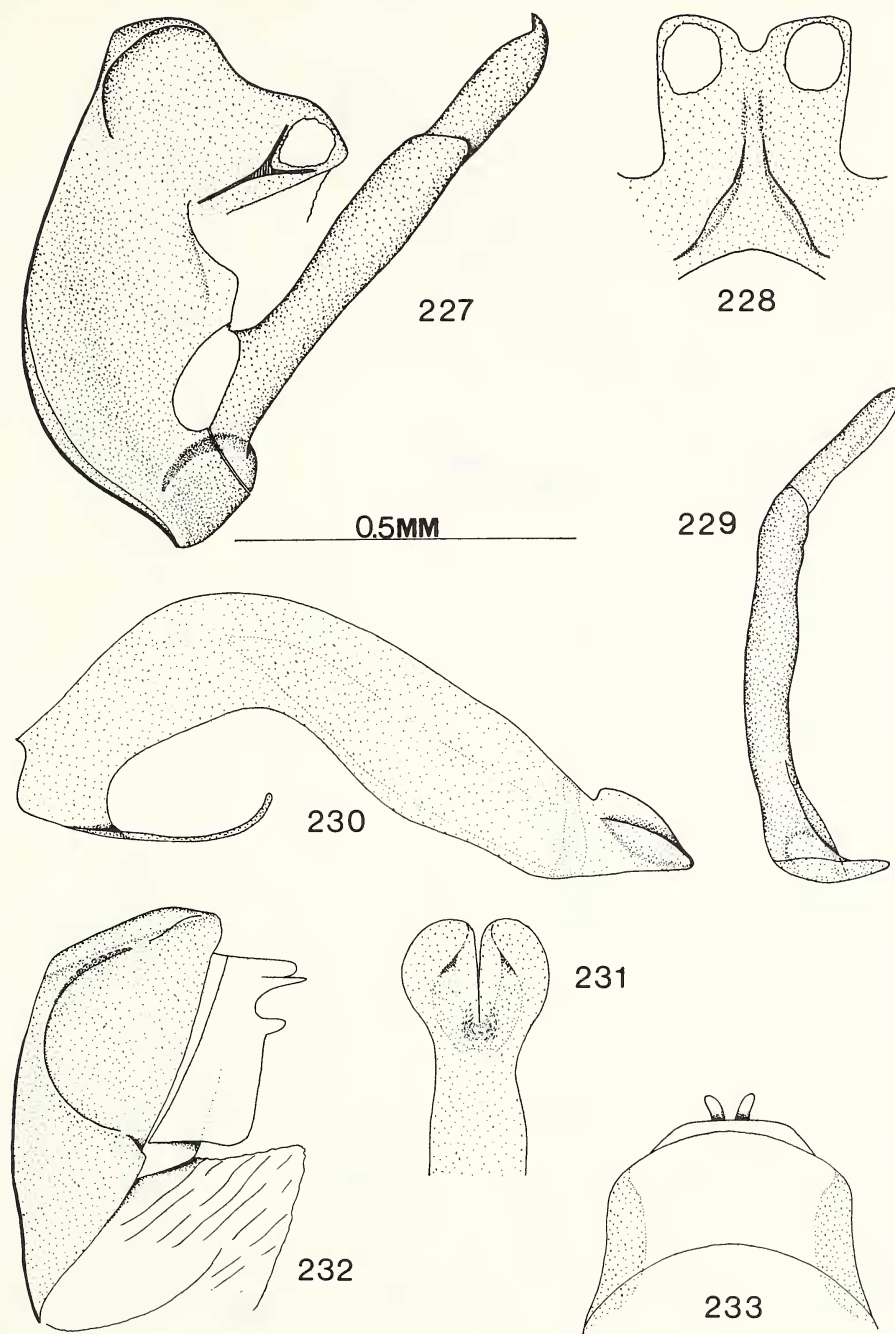


Fig. 227–233, *Hydropsyche frisoni* Ross: 227, genital capsule of male, lateral aspect; 228, genital capsule of male, dorsal aspect; 229, left clasper of male, posterior aspect; 230, aedeagus of male, lateral aspect; 231, aedeagus of male, dorsal aspect of tip; 232, genital segments of female, lateral aspect; 233, genital segments of female, dorsal aspect.

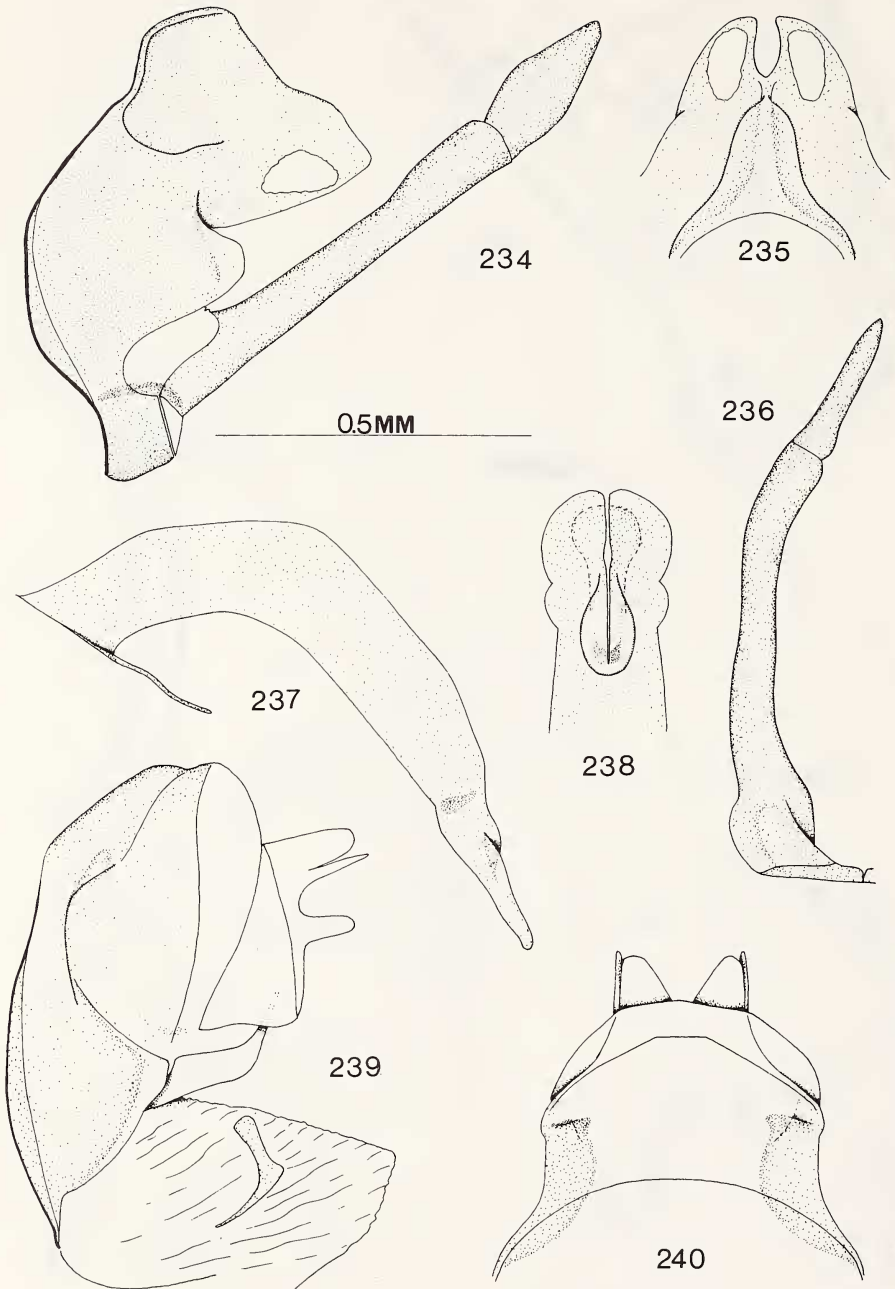


Fig. 234–240, *Hydropsyche hageni* Banks: 234, genital capsule of male, lateral aspect; 235, genital capsule of male, dorsal aspect; 236, left clasper of male, posterior aspect; 237, aedeagus of male, lateral aspect; 238, aedeagus of male, dorsal aspect of tip; 239, genital segments of female, lateral aspect; 240, genital segments of female, dorsal aspect.

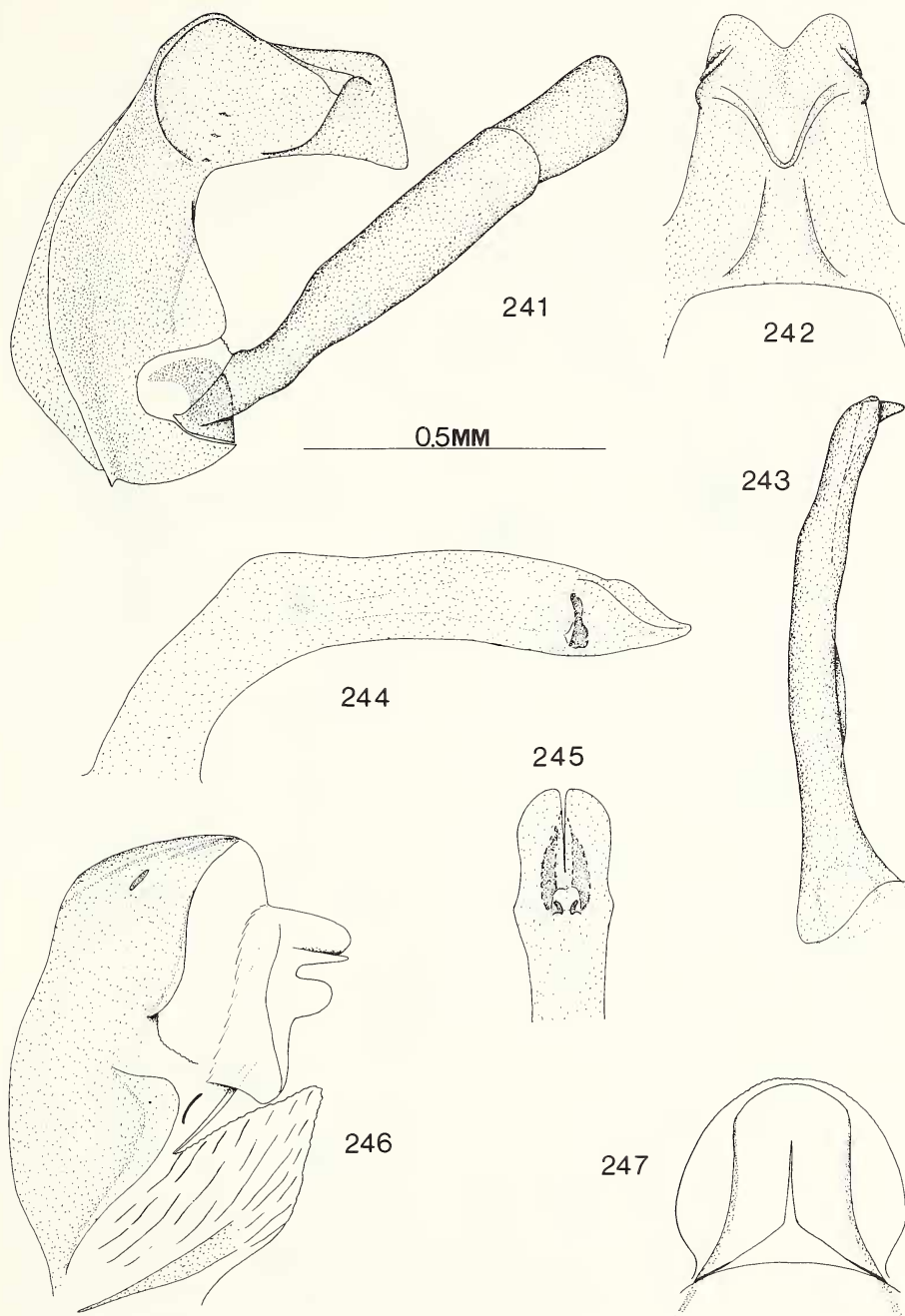


Fig. 241–247, *Hydropsyche occidentalis* Banks: 241, genital capsule of male, lateral aspect; 242, genital capsule of male, dorsal aspect; 243, left clasper of male, posterior aspect; 244, aedeagus of male, lateral aspect; 245, aedeagus of male, dorsal aspect of tip; 246, genital segments of female, lateral aspect; 247, genital segments of female, dorsal aspect.

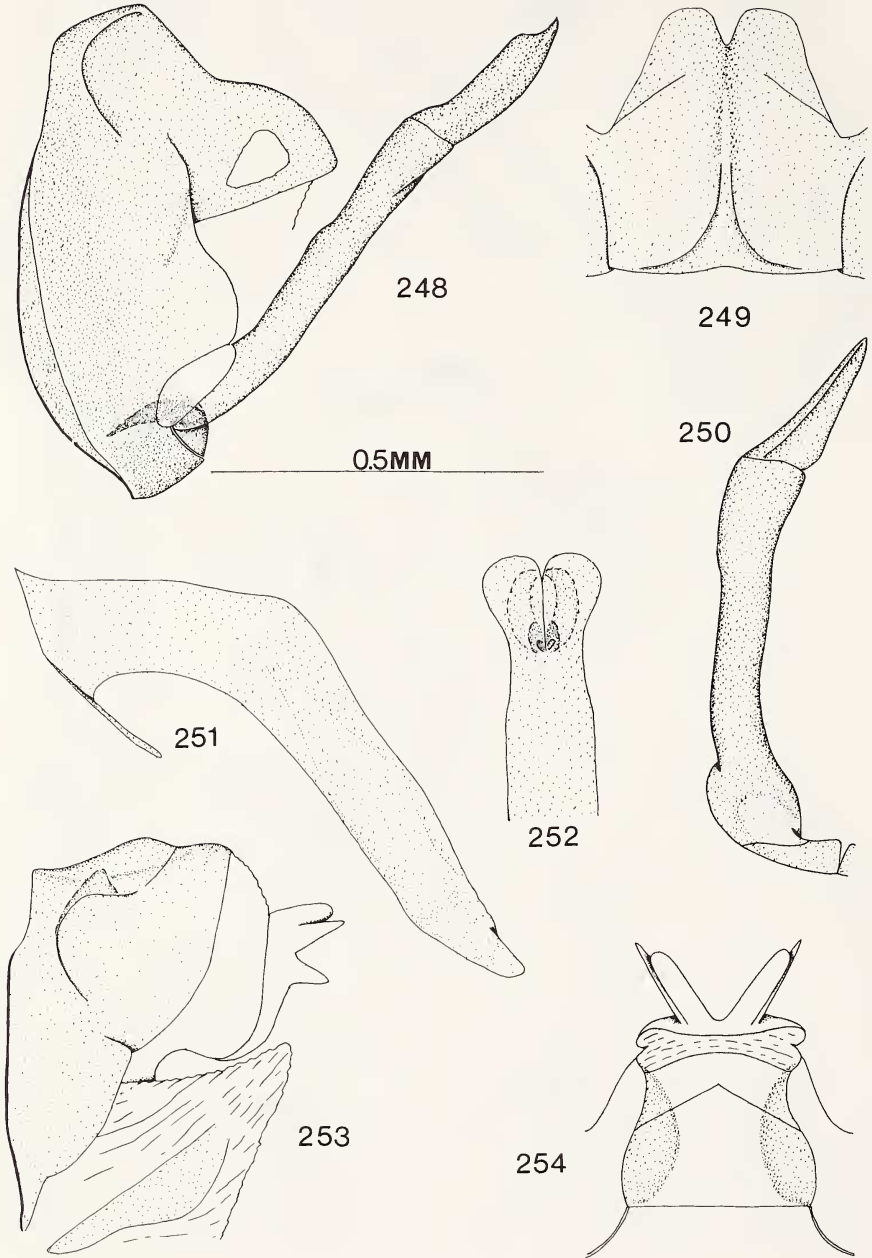


Fig. 248–254, *Hydropsyche orris* Ross: 248, genital capsule of male, lateral aspect; 249, genital capsule of male, dorsal aspect; 250, left clasper of male, posterior aspect; 251, aedeagus of male, lateral aspect; 252, aedeagus of male, dorsal aspect of tip; 253, genital segments of female, lateral aspect; 254, genital segments of female, dorsal aspect.



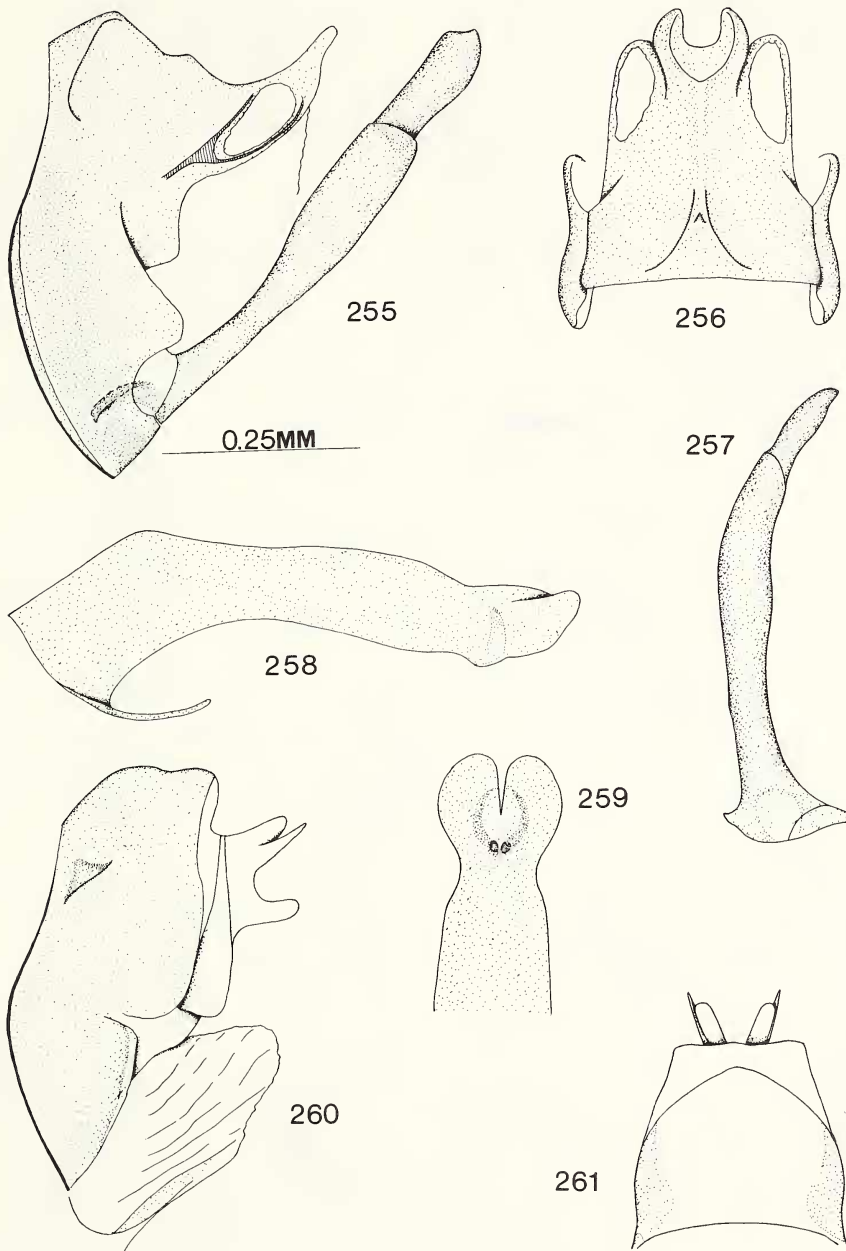


Fig. 255–261, *Hydropsyche phalerata* Hagen: 255, genital capsule of male, lateral aspect; 256, genital capsule of male, dorsal aspect; 257, left clasper of male, posterior aspect; 258, aedeagus of male, lateral aspect; 259, aedeagus of male, dorsal aspect of tip; 260, genital segments of female, lateral aspect; 261, genital segments of female, dorsal aspect.

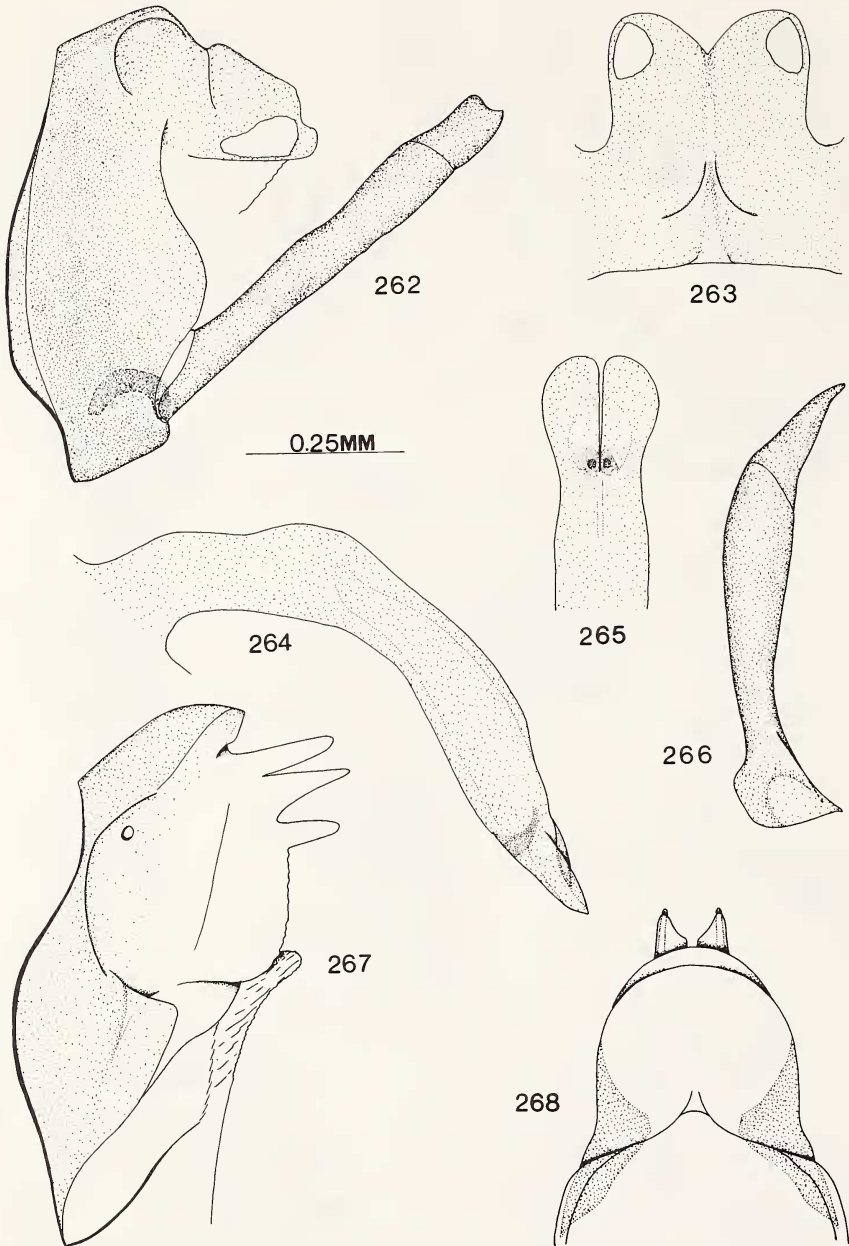


Fig. 262-268, *Hydropsyche placoda* Ross: 262, genital capsule of male, lateral aspect; 263, genital capsule of male, dorsal aspect; 264, aedeagus of male, lateral aspect; 265, aedeagus of male, dorsal aspect of tip; 266, left clasper of male, posterior aspect; 267, genital segments of female, lateral aspect; 268, genital segments of female, dorsal aspect.

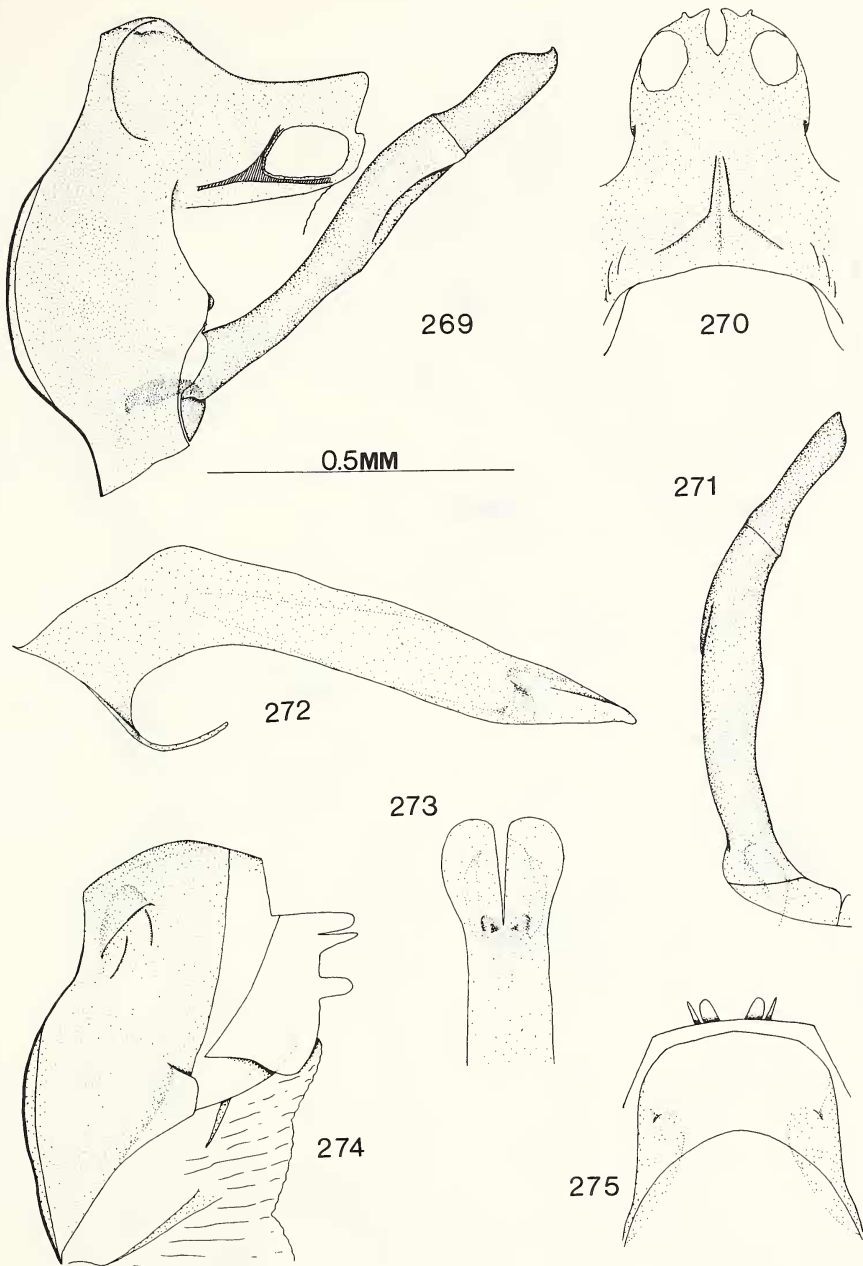


Fig. 269–275, *Hydropsyche rossi* Flint, Voshell, & Parker: 269, genital capsule of male, lateral aspect; 270, genital capsule of male, dorsal aspect; 271, left clasper of male, posterior aspect; 272, aedeagus of male, lateral aspect; 273, aedeagus of male, dorsal aspect of tip; 274, genital segments of female, lateral aspect; 275, genital segments of female, dorsal aspect.

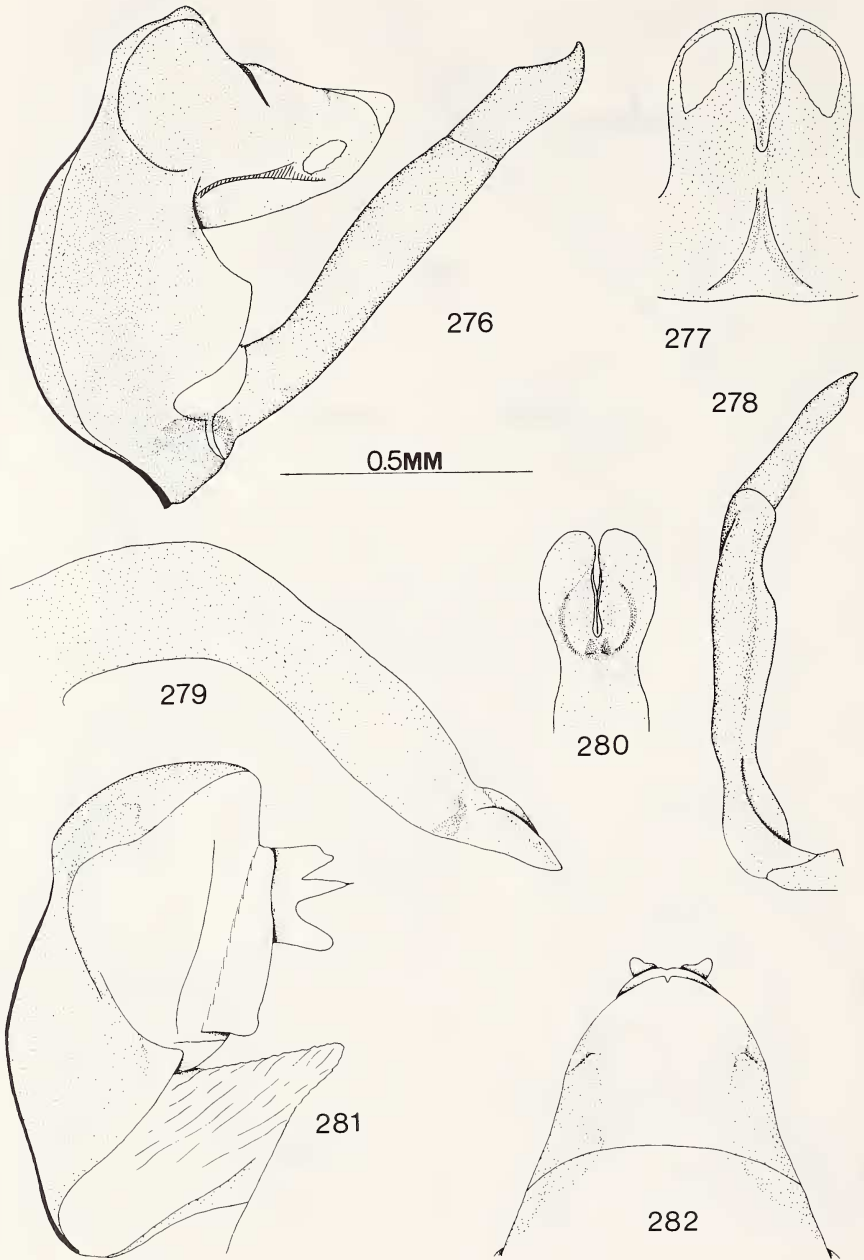


Fig. 276-282, *Hydropsyche scalaris* Hagen: 276, genital capsule of male, lateral aspect; 277, genital capsule of male, dorsal aspect; 278, left clasper of male, posterior aspect; 279, aedeagus of male, lateral aspect; 280, aedeagus of male, dorsal aspect of tip; 281, genital segments of female, lateral aspect; 282, genital segments of female, dorsal aspect.

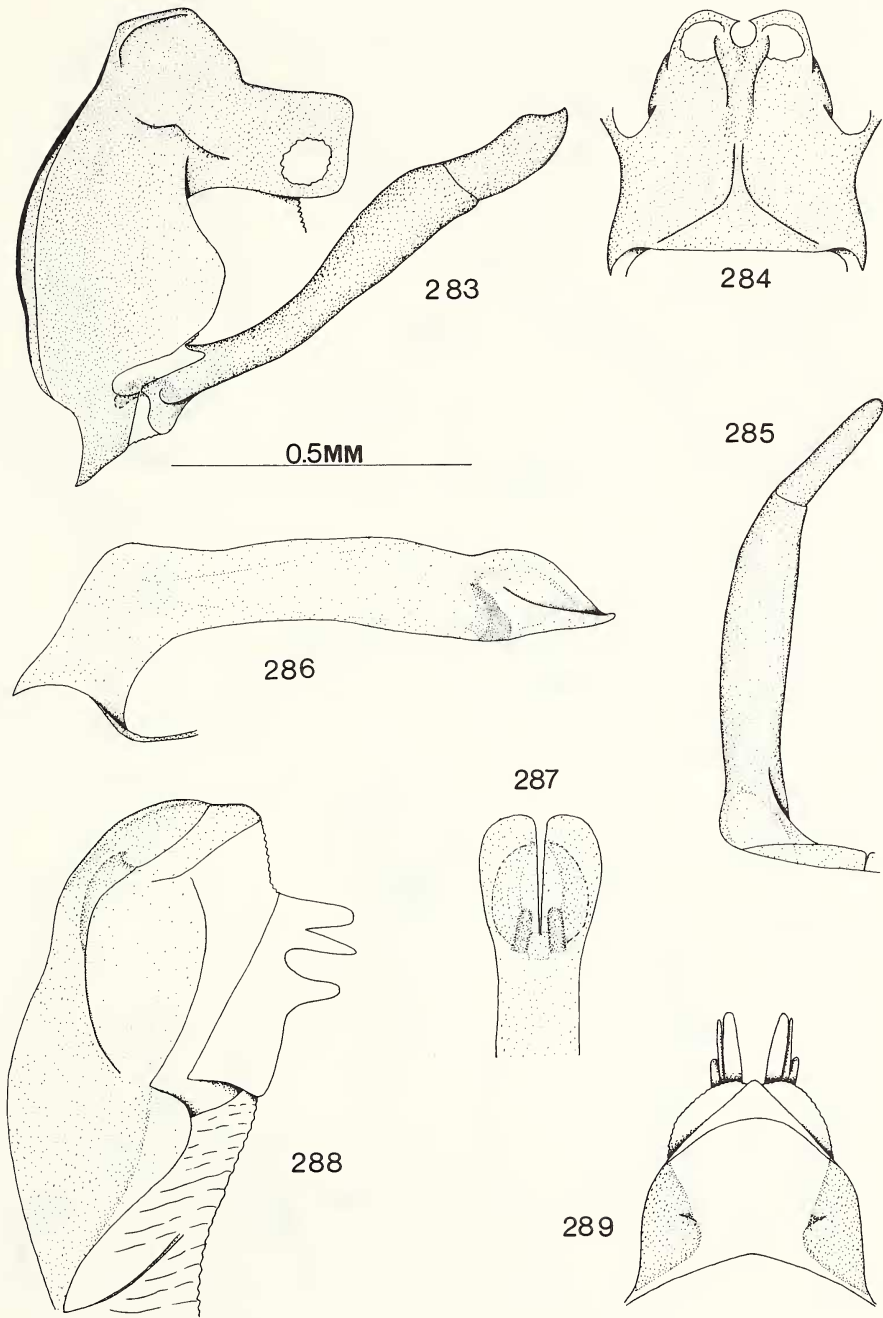


Fig. 283-289, *Hydropsyche simulans* Ross: 283, genital capsule of male, lateral aspect; 284, genital capsule of male, dorsal aspect; 285, left clasper of male, posterior aspect; 286, aedeagus of male, lateral aspect; 287, aedeagus of male, dorsal aspect of tip; 288, genital segments of female, lateral aspect; 289, genital segments of female, dorsal aspect.

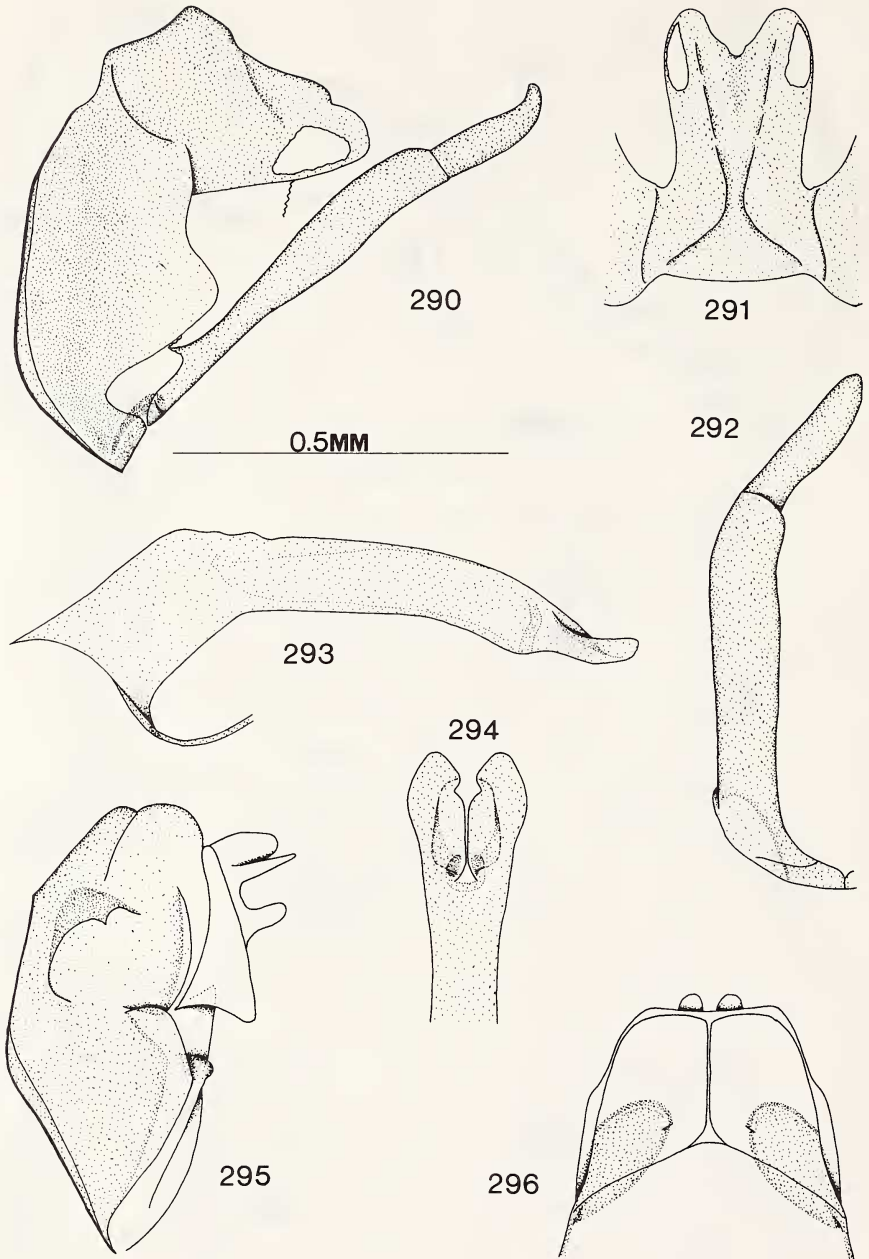


Fig. 290–296, *Hydropsyche valanis* Ross: 290, genital capsule of male, lateral aspect; 291, genital capsule of male, dorsal aspect; 292, left clasper of male, posterior aspect; 293, aedeagus of male, lateral aspect; 294, aedeagus of male, dorsal aspect of tip; 295, genital segments of female, lateral aspect; 296, genital segments of female, dorsal aspect.

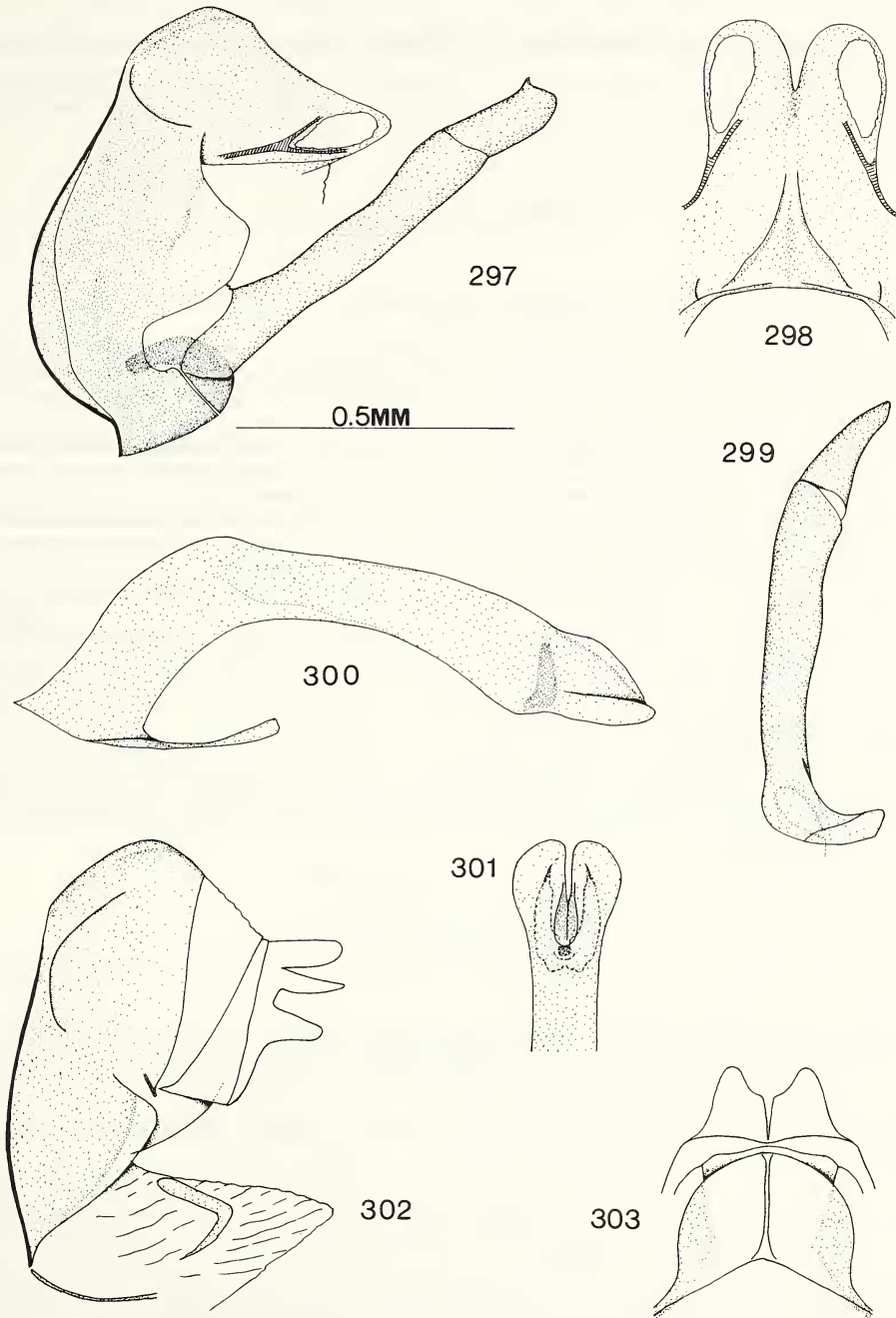


Fig. 297-303, *Hydropsyche venularis* Banks: 297, genital capsule of male, lateral aspect; 298, genital capsule of male, dorsal aspect; 299, left clasper of male, posterior aspect; 300, aedeagus of male, lateral aspect; 301, aedeagus of male, dorsal aspect of tip; 302, genital segments of female, lateral aspect; 303, genital segments of female, dorsal aspect.

## SPECIES GROUP 2

This small group of species characterised by aedeagus sclerotised throughout, with distal end roughly, transversely truncate, of more or less uniform width throughout; and by clasper receptacle of females simple, blind invagination of lateral wall of segment X, without inner opening.

*Hydropsyche betteni* Ross

Map 49; Fig. 304–310

*Hydropsyche betteni* Ross, 1938b:146; Denning, 1943:122; Ross, 1944:99; Schuster & Etnier, 1978:61.

*Hydropsyche incommoda* not Hagen; Betten, 1934:188.

**Description.**— Male fore-wing length 10.53 mm; warm red-brown, with darker areas concentrated about Cu1 to A3. Hind-wing faintly tinted brown. Antennae red-brown; basal eight flagellar annuli each with oblique, dark band. Vertex yellow-brown. Spurs pale brown; lateral member of middle and hind-leg pairs shorter than mesal companions. Thorax deep, rich red-brown, to paler laterally. Legs brownish yellow; red-brown in female.

**Genitalia.** Male. (Fig. 304–308). (Specimen from St John's, Newfoundland). Males distinguished by aedeagus, in lateral aspect (Fig. 307), with base curved ventrad of remainder, in semi-circle; and by gap between distal lobes of tergum X, in dorsal aspect (Fig. 305), vase-shaped, each side of wider outer limit with distal tooth.

**Genitalia.** Female. (Fig. 309–310). (Specimen from St John's, Newfoundland). Females distinguished by clasper receptacle widened internally (Fig. 309), without inner opening (Fig. 310), with two lobes on floor of outer opening of receptacle; and by small, curved, slender secondary sclerotised strap laterally on vulval scale.

**Biology.**— Ross (1944) indicates that larvae prefer small to medium, riffled streams. They have been recorded in water film of dam spillways. Schuster & Etnier (1978) add that warmer waters are preferred; also, that this species is one of the more pollution-tolerant in *Hydropsyche*. It is, also, often the only *Hydropsyche* species in given streams. Canadian flight season extends from May 18 to October 2.

**Distribution.**— Recorded from Saskatchewan to Arkansas, Georgia, and Newfoundland, the species appears to be general throughout eastern North America, with extensions into the Boreal Forest (Map 49). In Canada it is recorded from Saskatchewan, then from northwestern Ontario to Newfoundland.

*Hydropsyche confusa* (Walker)

Map 50; Fig. 311–317

*Philopotamus confusus* Walker, 1852:103.

*Hydropsyche confusa*; Milne, 1936:61; Betten & Mosely, 1940:21; Nimmo, 1981:259.

*Hydropsyche seperata* Banks, 1936:129; Denning, 1943:121; Ross & Spencer, 1952:46 (as synonym of *H. guttata* Pictet);

Smith, 1979:10; Nimmo, 1981:259 (as synonym of *H. confusa* (Walker)).

*Hydropsyche guttata* Pictet; Schuster & Etnier, 1978:126.

*Hydropsyche corbetti* Nimmo, 1966a:688; Schuster & Etnier, 1978:126 (as synonym of *H. guttata* Pictet); Nimmo, 1981:259 (as synonym of *H. confusa* (Walker)).

**Description.**— Male fore-wing length 8.66 mm; bright grey-brown, faintly irrorate; darker in female. Antennae brownish cream; basal nine flagellar annuli each with oblique, dark band. Vertex dark grey-brown. Spur formula 1,4,4 in male; 2,4,4 in female; pale brown; lateral member of middle leg pairs notably shorter than mesal companions. Thorax dark brown, to orange-brown laterally. Legs dull pale brown.

**Genitalia.** Male. (Fig. 311–315). (Specimen from Empress, Alberta). Males distinguished by distal article of clasper, in lateral aspect (Fig. 311), long, slightly bulbous distally, curved dorsad; by distal article, in posterior aspect (Fig. 313), hooked mesad; and by almost total lack of gap between distal lobes of tergum X, in dorsal aspect (Fig. 312).

**Genitalia.** Female. (Fig. 316–317). (Specimen from Empress, Alberta). Females distinguished by large, rounded clasper receptacle, in lateral aspect (Fig. 316), with two lobes on floor of receptacle entrance; and by presence of small, angled, secondary sclerotised strap on side of vulval scale.



**Biology.**— Smith (1979) presents a comprehensive account from Saskatchewan: univoltine, with extended emergence and flight season; pupae obtained from May 26 to August 24, with peak in June-July; larvae primarily detritivores and herbivores; appear to prefer larger, more turbid rivers.

**Distribution.**— Presently known from British Columbia and Washington to Québec in east, and Hudson's Bay and arctic coasts in north, this species is known in United States only from northern tier of States (Map 50). Canadian distribution records scattered; this species is recorded from nearly the southern-most point to Canadian Arctic Coast, though not north of tree line. Not known from eastern Québec or Atlantic Provinces.

*Hydropsyche cuanis* Ross

Map 51; Fig. 318–324

*Hydropsyche cuanis* Ross, 1938b:147; Ross, 1944:100; Schuster & Etnier, 1978:70.

**Description.**— Male fore-wing length 9.36 mm; light orange-brown, with no evident markings. Hind-wing faintly tinted. Antennae yellow; basal eight flagellar annuli each with oblique, dark band (five in female). Vertex deep reddish brown, narrowed anterad, with compound eyes of male much larger, relatively, than in most other species; female normal. Spurs yellow; lateral member of middle and hind-leg pairs notably shorter than mesal companions; applicable in the female to middle leg pairs only. Thorax rich red-brown, to more orange-brown laterally. Legs pale orange-brown to straw.

**Genitalia.** Male. (Fig. 318–322). (Specimen from Mokence, Illinois, USA). Males distinguished by basal article of clasper narrow at base, widened distally, in lateral aspect (Fig. 318); by uniform width of basal article, in posterior aspect (Fig. 320); by distal article narrowed in two stages, to acuminate tip (Fig. 318); and by gap between tergum X distal lobes v-shaped.

**Genitalia.** Female. (Fig. 323–324). (Specimen from Kankakee R., Willington, Illinois, USA – Paratype). Females distinguished by sclerotised strap of vulval scale narrow, sinuate (Fig. 323); by clasper receptacle relatively narrow, rounded, directed dorso-anterad, without grooves or lobes on receptacle floor (Fig. 323); and by receptacle without inner opening (Fig. 324).

**Biology.**— Ross (1944) indicates that larvae prefer swift rapids areas of larger rivers. Flight season apparently commences with May peak, which declines into August.

**Distribution.**— Limited to mid-west States of USA (Map 51). Not yet known from Canada.

*Hydropsyche depravata* Hagen

Map 52; Fig. 325–331

*Hydropsyche depravata* Hagen, 1861:290; Betten, 1934:187; Milne, 1936:70, 72, 73; Ross, 1944:100; Schuster & Etnier, 1978:63.

**Description.**— Male fore-wing length 9.75 mm; grey-brown, uniformly irrorate. Hind-wing very faintly tinted grey-brown. A tennae red-brown; basal nine flagellar annuli each with oblique, dark band – eight in female. Vertex dark brown. Spurs brown – yellow in female; lateral member of all pairs shorter than mesal companions. Thorax dark brown, to red-brown laterally. Legs straw-coloured.

**Genitalia.** Male. (Fig. 325–329). (Specimen from Beaver Ck, Knox Co., Tennessee, USA). Males distinguished by distal article of clasper, in lateral aspect (Fig. 325), evenly tapered from base to rounded tip (tip curved abruptly); by pair of black sclerites housed in tip of aedeagus, as seen in dorsal aspect (Fig. 329); and by gap between tergum X distal lobes wide, v-shaped, not deep (Fig. 326).

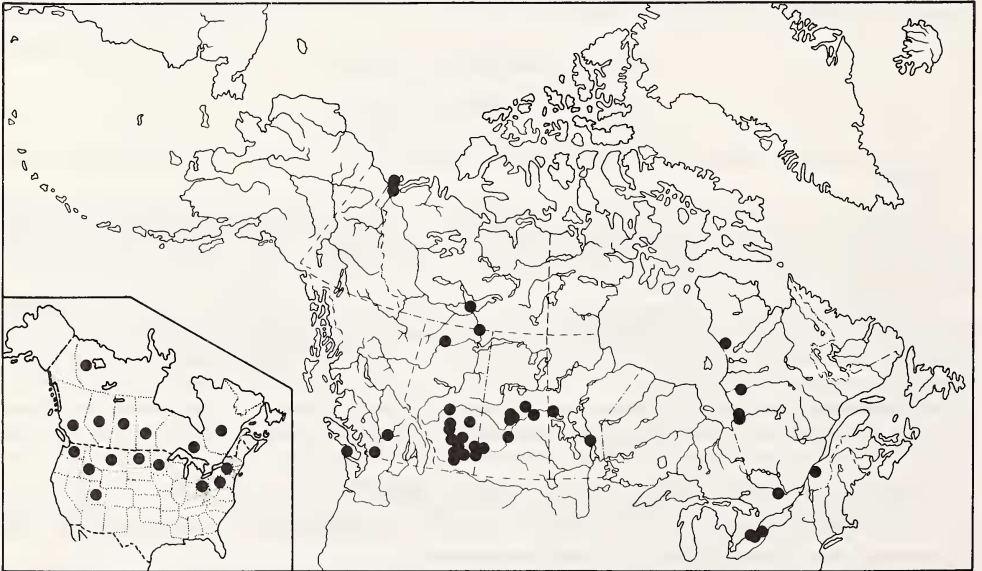
**Genitalia.** Female. (Fig. 330–331). (Specimen from Beaver Ck, Knox Co., Tennessee, USA). Females distinguished by clasper receptacle large, rounded, with pair of grooves on floor of receptacle opening, without inner opening (Fig. 330, 331); and by only dorsal lobes of segment XI visible in dorsal aspect.

**Biology.**— Schuster & Etnier (1978) state that larvae live in warm-water, small streams with high organic loading. Apparently found mostly on medium-sized rocks in riffles. Only flight record available is for July 26, in Saskatchewan.

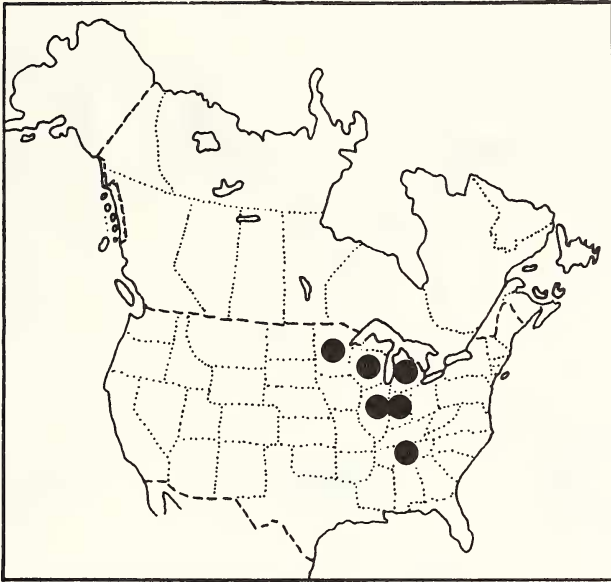
**Distribution.**— Primarily known from Indiana to Georgia to Virginia, with isolated record from prairie of southern Saskatchewan, in Canada (Map 52).



Map 49. Collection localities for *Hydropsyche betteni* Ross in Canada, with known distribution in North America by state or province.



Map 50. Collection localities for *Hydropsyche confusa* (Walker) in Canada, with known distribution in North America by state or province.



Map 51. Known distribution of *Hydropsyche cuanis* Ross in North America, by state.



Map 52. Collection localities for *Hydropsyche depravata* Hagen in Canada, with known distribution in North America by state or province.

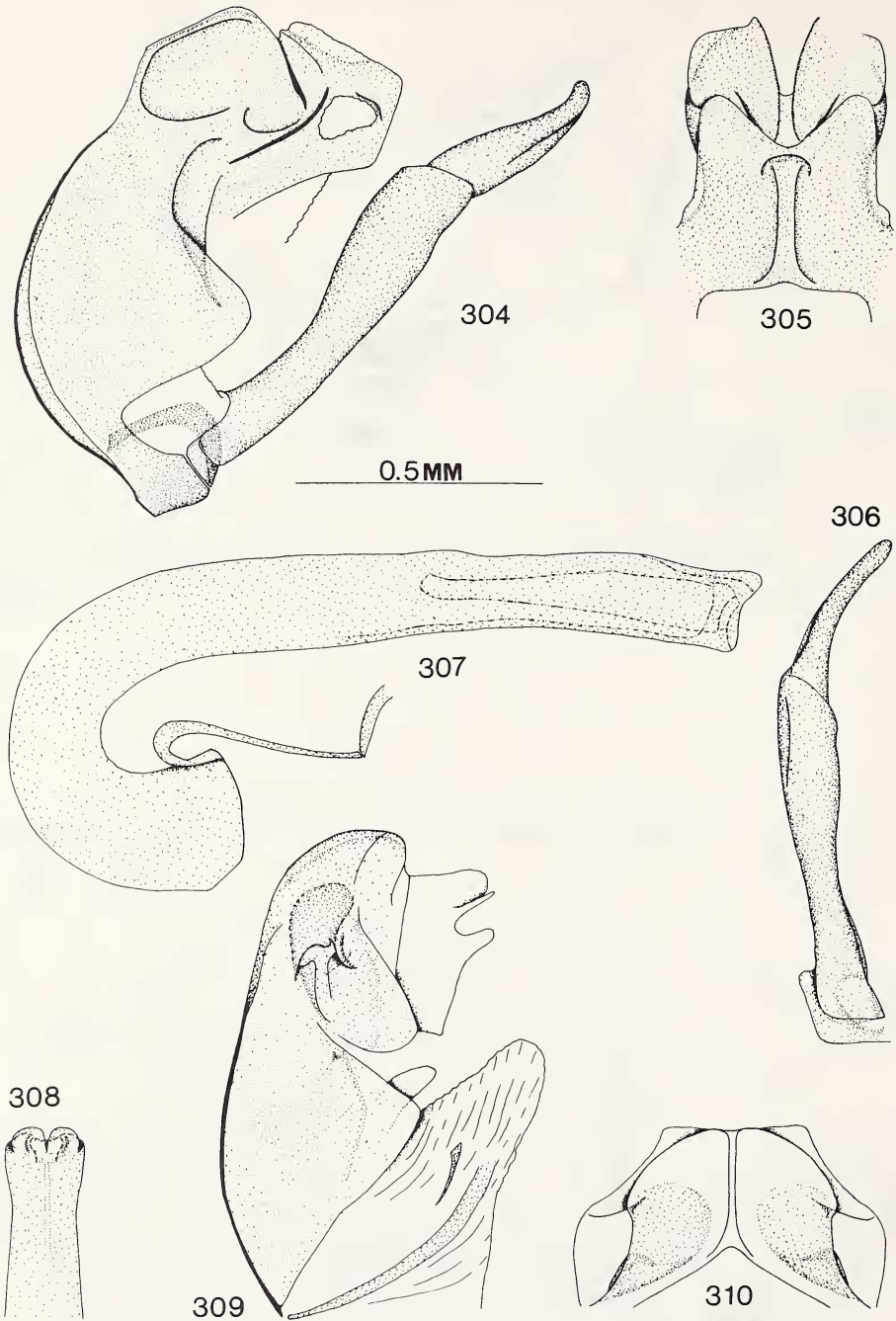


Fig. 304–310, *Hydropsyche betteni* Ross: 304, genital capsule of male, lateral aspect; 305, genital capsule of male, dorsal aspect; 306, left clasper of male, posterior aspect; 307, aedeagus of male, lateral aspect; 308, aedeagus of male, dorsal aspect of tip; 309, genital segments of female, lateral aspect; 310, genital segments of female, dorsal aspect.

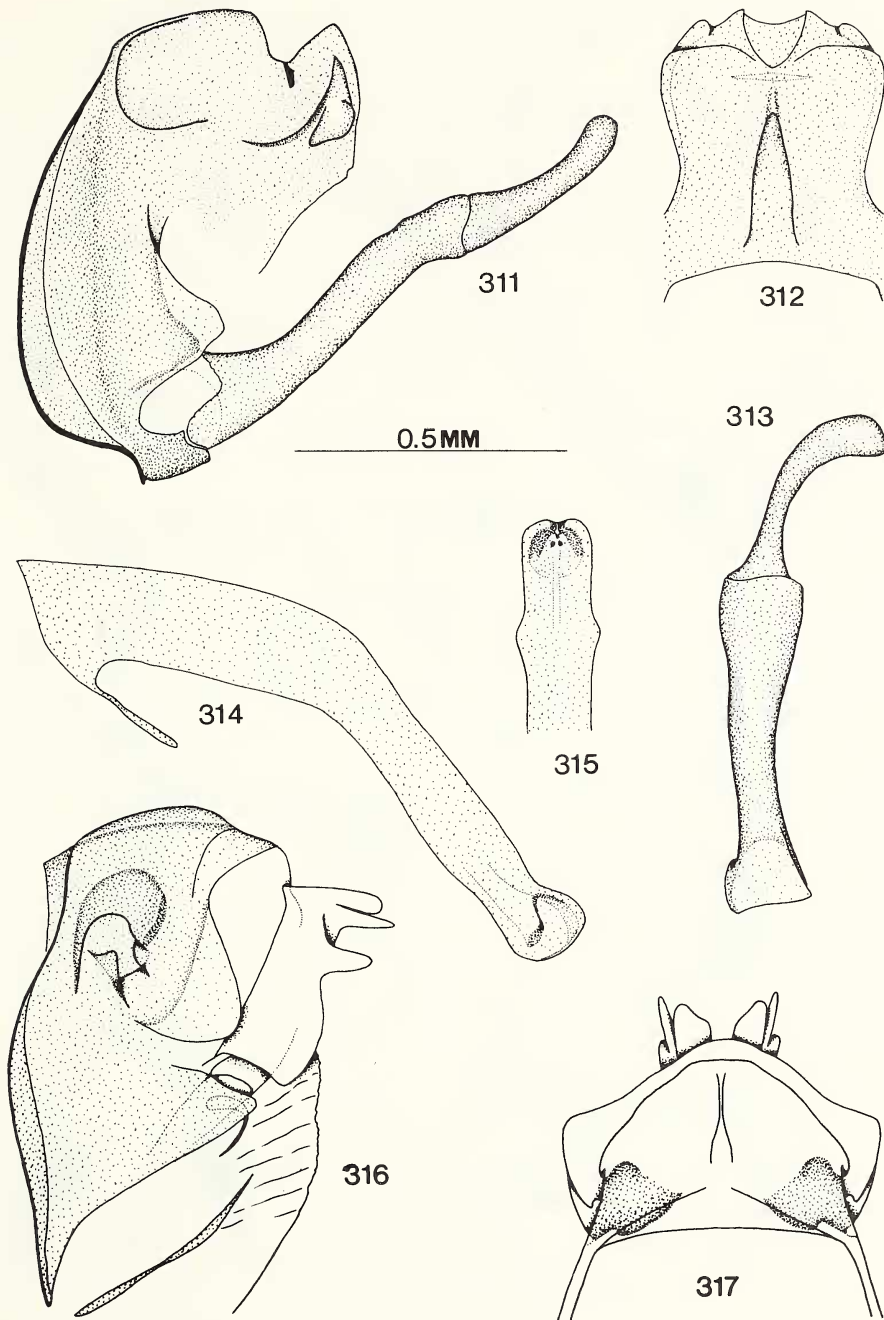


Fig. 311–317, *Hydropsyche confusa* (Walker): 311, genital capsule of male, lateral aspect; 312, genital capsule of male, dorsal aspect; 313, left clasper of male, posterior aspect; 314, aedeagus of male, lateral aspect; 315, aedeagus of male, dorsal aspect of tip; 316, genital segments of female, lateral aspect; 317, genital segments of female, dorsal aspect.

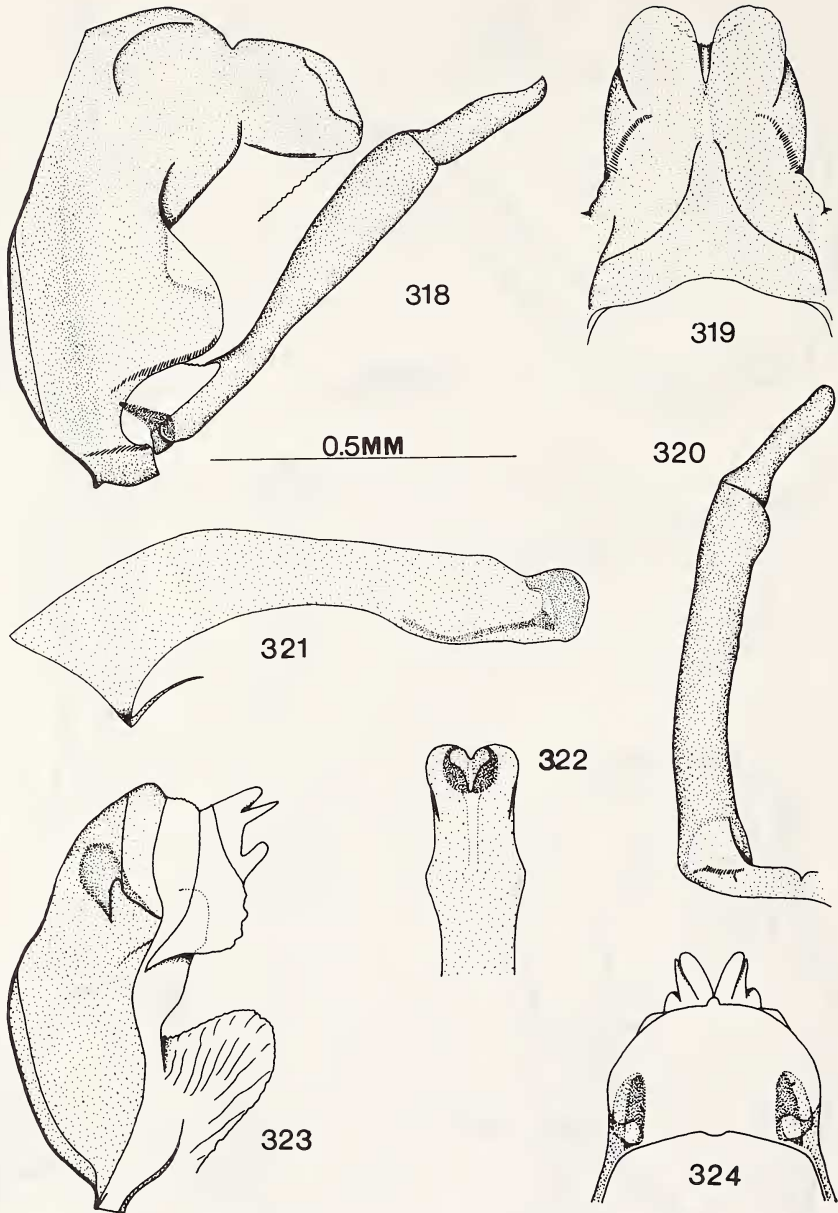


Fig. 318–324, *Hydropsyche cuanis* Ross: 318, genital capsule of male, lateral aspect; 319, genital capsule of male, dorsal aspect; 320, left clasper of male, posterior aspect; 321, aedeagus of male, lateral aspect; 322, aedeagus of male, dorsal aspect of tip; 323, genital segments of female, lateral aspect; 324, genital segments of female, dorsal aspect.

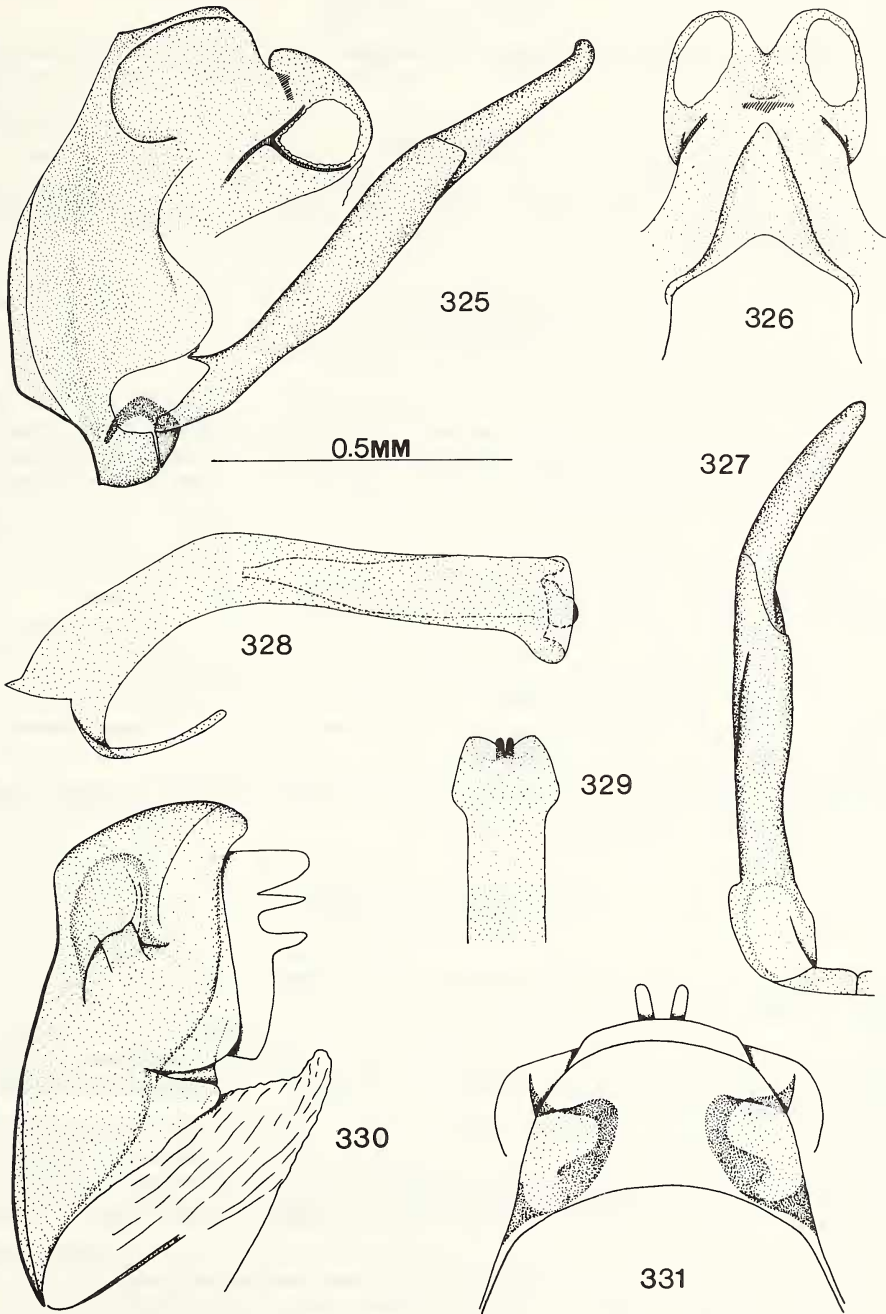


Fig. 325–331, *Hydropsyche depravata* Hagen: 325, genital capsule of male, lateral aspect; 326, genital capsule of male, dorsal aspect; 327, left clasper of male, posterior aspect; 328, aedeagus of male, lateral aspect; 329, aedeagus of male, dorsal aspect of tip; 330, genital segments of female, lateral aspect; 331, genital segments of female, dorsal aspect.

## SPECIES GROUP 3

This group characterised by aedeagus with toothed and/or spinate membranous lobes distally.

## SUBGROUP A

This subgroup characterised by possession of membranous lobes on aedeagus both dorsally and ventro-laterally.

*Hydropsyche ambilis* Ross

Map 53; Fig. 332–338

*Hydropsyche ambilis* Ross, 1938a:120; Ross, 1944:294; Anderson, 1976:65; Schefter & Wiggins, 1986:51.

*Description*.— Male fore-wing length 9.13 mm; pale cream-brown, with hint of irroration around distal edge. Hind-wing hyaline. Antennae red-brown; no oblique dark bands. Vertex dark brown, warts cream. Spurs straw-coloured; lateral member of middle leg pairs, and hind-leg apical pair, notably shorter than mesal companions. Thorax deep red-brown, to paler laterally. Legs straw coloured.

*Genitalia*. Male. (Fig. 332–336). (Specimen from East Fork, Humbug Ck, Clatsop Co., Oregon, USA). Males distinguished by massive, postero-ventrally directed distal lobes of tergum X, in lateral aspect (Fig. 332); by tooth of dorsal lobe of aedeagus directed postero-dorsad (Fig. 335); by ventro-lateral lobes of aedeagus directed antero-ventrad, with bundle of spines at tip; and by tip of distal article of clasper, in lateral aspect, with small curved indentation.

*Genitalia*. Female. (Fig. 337–338). (Specimen from Okop Ck, Eatonville, Washington, USA). Females distinguished by small, anteriorly directed clasper receptacle traversed by thin, dark line which passes down lateral wall of segment X; by small, irregular sclerotised strap of vulval scale (Fig. 337); and by clasper receptacle, in dorsal aspect (Fig. 338), directed antero-mesad, without visible inner openings.

*Biology*.— Anderson (1976) suggests that larvae prefer small streams. Emergence has been recorded from early May to mid-August in Oregon.

*Distribution*.— Presently known only from Lower Mainland of British Columbia, Canada and from Washington and Oregon, USA (Map 53).

*Hydropsyche piatrix* Ross

Map 54; Fig. 339–345

*Hydropsyche piatrix* Ross, 1938b:148; Ross, 1944:97; Schefter & Wiggins, 1986:68.

*Symphitopsyche piatrix*; Schuster & Etnier, 1978:57.

*Description*.— Male fore-wing length 7.84 mm; uniform yellowish brown, very faintly irrorate. Hind-wing paler. Antennae pale yellowish brown, no oblique, dark bands. Vertex brown, warts paler. Spurs brownish straw; lateral member of middle leg pairs notably shorter than mesal companions. Thorax dark brown, to grey-brown laterally. Legs pale brownish straw, to straw.

*Genitalia*. Male. (Fig. 339–343). (Specimen from Mammoth Springs, Arkansas, USA – Paratype). Males distinguished by tergum X distal lobes small, rounded, curved slightly ventrad in lateral aspect (Fig. 339); by these lobes, in dorsal aspect, finger-like, curved postero-mesad, gap between elliptical; by ventro-lateral lobe of aedeagus tapered anterad, without teeth or spines (Fig. 342); and by dorsal lobe not produced, with minute tooth directed slightly antero-laterad.

*Genitalia*. Female. (Fig. 344–345). (Specimen from Mammoth Springs, Arkansas, USA). Females distinguished by clasper receptacle directed dorso-posterad in lateral aspect (Fig. 344), meso-posterad in dorsal aspect (Fig. 345); by vulval scale with two sclerotised straps in lateral aspect – primary club-shaped, secondary triangular, dorsal; and by segment XI dorsal lobe, in dorsal aspect (Fig. 345) large enough to obscure all beneath, with mesal shoulder.

*Biology*.— Very little known except that this species has been taken only at spring-like waters (Schuster & Etnier, 1978). Only flight dates available are from June and early July.

*Distribution*.— Very scattered – North Dakota, Missouri, Arkansas, and St Lawrence R. valley of Québec (Map 54).



*Hydropsyche vexa* Ross

Map 55; Fig. 346–352

*Hydropsyche vexa* Ross, 1938b:148; Denning, 1943:124; Ross, 1944:97; Schefter & Wiggins, 1986:81.  
*Symphitopsyche vexa*; Schuster & Etnier, 1978:127.

**Description.**— Male fore-wing length 7.41 mm; golden brown, faintly irrorate. Antennae pale brown; basal seven or eight flagellar annuli each with oblique, dark band; five in female, paler. Vertex orange-brown. Spurs yellow; lateral member of middle leg pairs, and hind-leg apical pair, notably shorter than mesal companions; applies only to middle leg pairs in female. Thorax orange-brown, to yellow-brown laterally. Legs pale brownish yellow.

**Genitalia.** Male. (Fig. 346–350). (Specimen from White Earth R., Hwy 28, Alberta). Males distinguished by basal article of clasper, in lateral aspect (Fig. 346), with slender base, expanded distally; by tergum X distal lobes long, thin, curved slightly ventrad in lateral aspect (Fig. 346), curved mesad in dorsal aspect (Fig. 347), space between almost enclosed; by dorsal membranous lobe of aedeagus small, with small, acuminate tooth directed posterad (Fig. 349, 350); and by ventro-lateral lobe of aedeagus long, straight, directed antero-ventrad, with distal pocket of spines.

**Genitalia.** Female. (Fig. 351–352). (Specimen from White Earth R., Hwy 28, Alberta). Females distinguished by clasper receptacle, in lateral aspect (Fig. 351), directed dorsad, of medium size, with two grooves on floor at entrance; and by clasper receptacle, in dorsal aspect (Fig. 352), curved postero-mesad.

**Biology.**— Very little known. Flight records extend from May 22 to August 8 in Canada.

**Distribution.**— Recorded in narrow zone across Continent, from Idaho and Alberta to New Brunswick and Maine (Map 55). In Canada known only from Prairie Provinces, Montréal, and New Brunswick.

*Hydropsyche walkeri* Betten & Mosely

Map 56; Fig. 353–359

*Hydropsyche maculicornis* Walker, 1852:113 (preoccupied by Pictet, 1834 – now in *Tinodes*).

*Hydropsyche walkeri* Betten & Mosely, 1940:23 (new name); Ross, 1944:96; Schefter & Wiggins, 1986:83.  
*Symphitopsyche walkeri*; Schuster & Etnier, 1978:35.

**Description.**— Male fore-wing length 7.53 mm; pale red-brown. Hind-wing very palely tinted yellow-brown. Antennae uniformly brown. Vertex dark reddish brown, warts paler. Spurs yellow-brown; lateral member of fore-leg apical pair much finer than mesal companion, hyaline. Thorax dark reddish brown, to grey-brown laterally. Legs yellowish brown. Warts, generally, paler.

**Genitalia.** Male. (Fig. 353–357). (Specimen from St Hippolyte, Québec). Males distinguished by distal article of clasper with distal half bent dorsad at approximately 45° to basal half, with tip slightly scalloped (Fig. 353); by tergum X distal lobes with dorsal edge angled in lateral aspect (Fig. 353), lobes curved mesad, in dorsal aspect (Fig. 354), space between almost enclosed; by aedeagus with ventro-lateral lobe directed basad along side (Fig. 356); and by dorsal lobes of aedeagus slightly developed, tooth directed postero-dorsad.

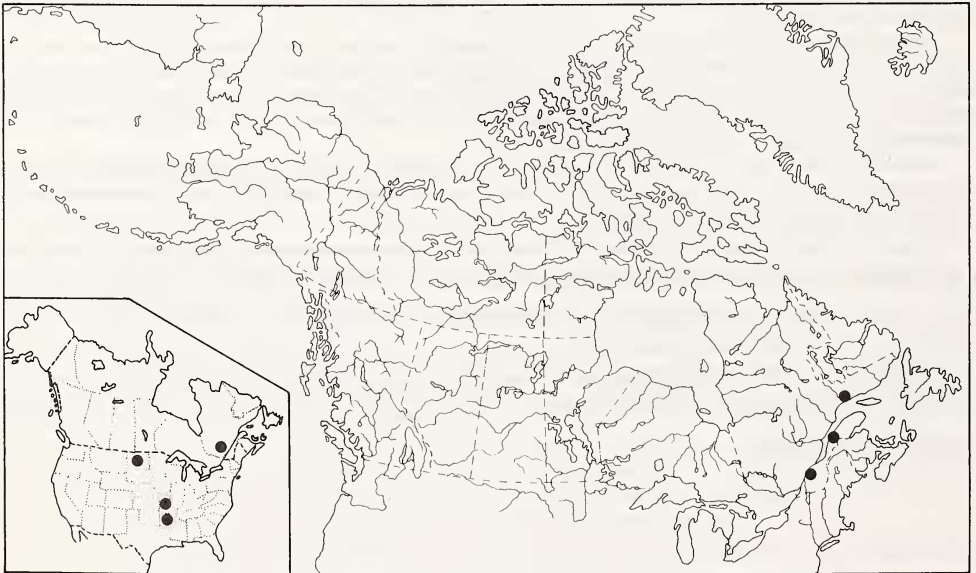
**Genitalia.** Female. (Fig. 358–359). (Specimen from St Hippolyte, Québec). Females distinguished by large, crescent-shaped clasper receptacle located in postero-dorsal angle of segment X (Fig. 358); and by sclerotised strap of vulval scale large, long, wide except tapered basad.

**Biology.**— According to Schuster & Etnier (1978) larvae appear to prefer small to medium sized streams with coarse gravel to small rock bottom, which are rich in organic materials. Riffle areas appear to be preferred, with smoothly-flowing water. Canadian flight season extends from May 5 to September 2.

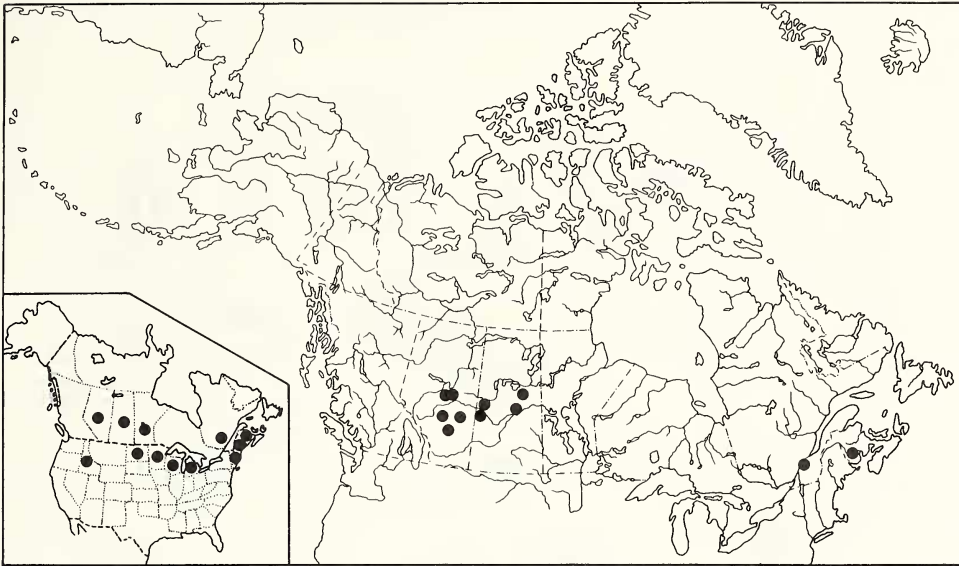
**Distribution.**— From Saskatchewan to Virginia, Maine, and Québec (Map 56). In Canada recorded from northcentral Saskatchewan to east coast of Hudson's Bay, south to southern Québec and Ontario.



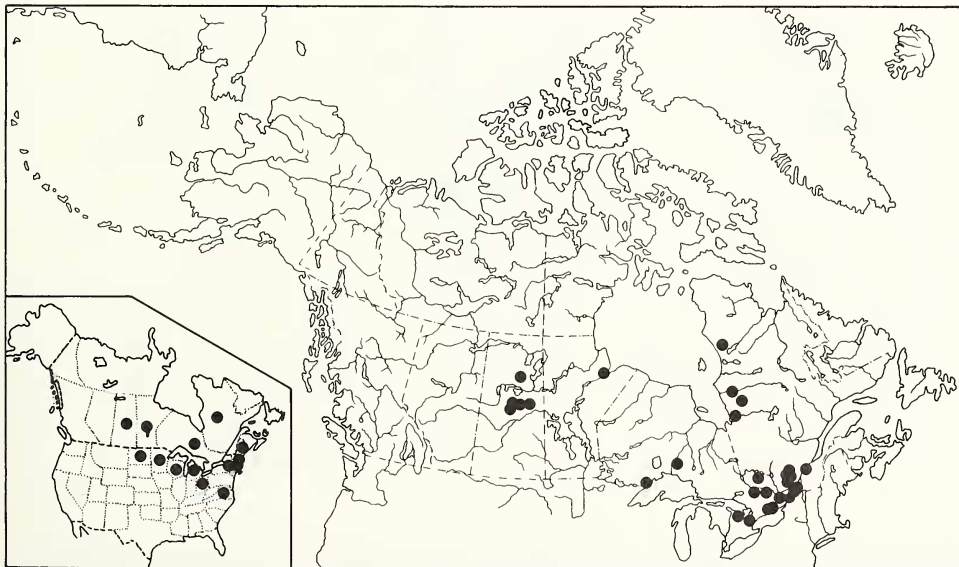
Map 53. Collection localities for *Hydropsyche ambilis* Ross in Canada, with known distribution in North America by state or province.



Map 54. Collection localities for *Hydropsyche piatrix* Ross in Canada, with known distribution in North America by state or province.



Map 55. Collection localities for *Hydropsyche vexa* Ross in Canada, with known distribution in North America by state or province.



Map 56. Collection localities for *Hydropsyche walkeri* Betten & Mosely in Canada, with known distribution in North America by state or province.

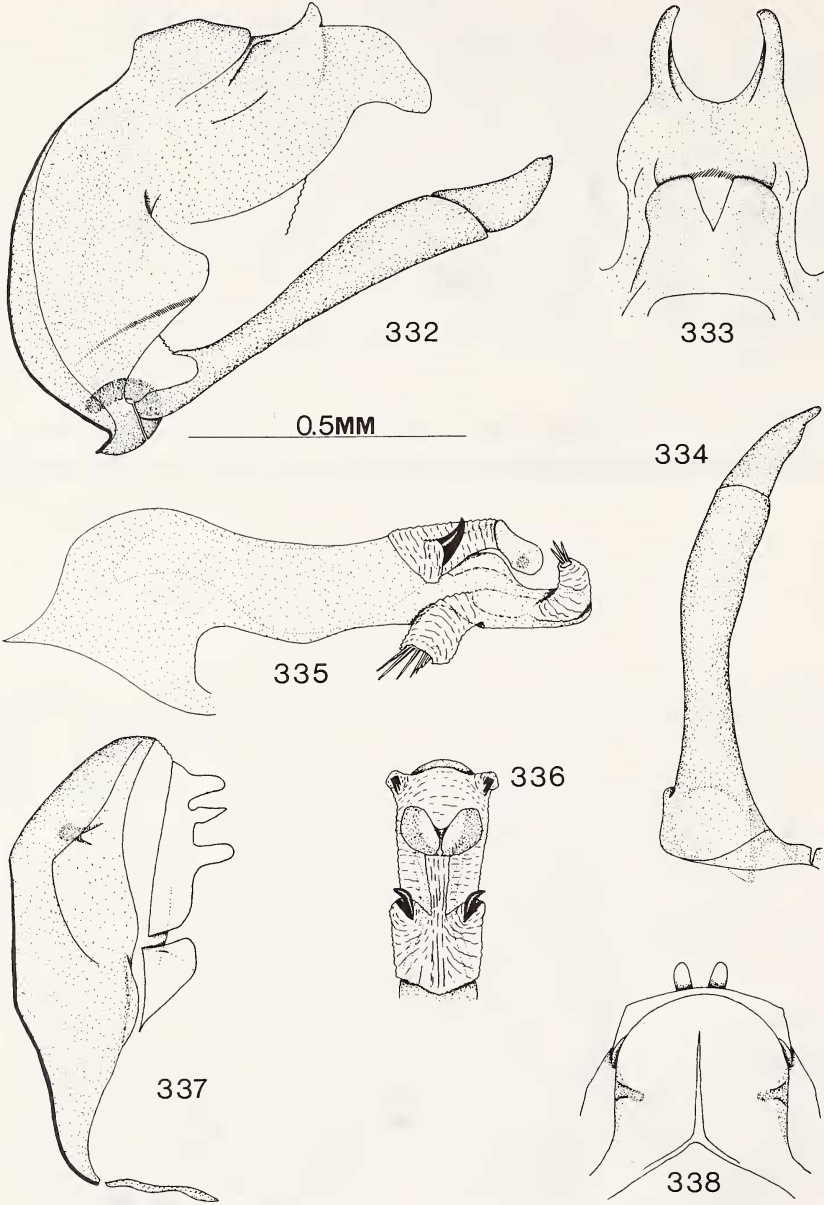


Fig. 332-338, *Hydropsyche amblis* Ross: 332, genital capsule of male, lateral aspect; 333, genital capsule of male, dorsal aspect; 334, left clasper of male, posterior aspect; 335, aedeagus of male, lateral aspect; 336, aedeagus of male, dorsal aspect of tip; 337, genital segments of female, lateral aspect; 338, genital segments of female, dorsal aspect.

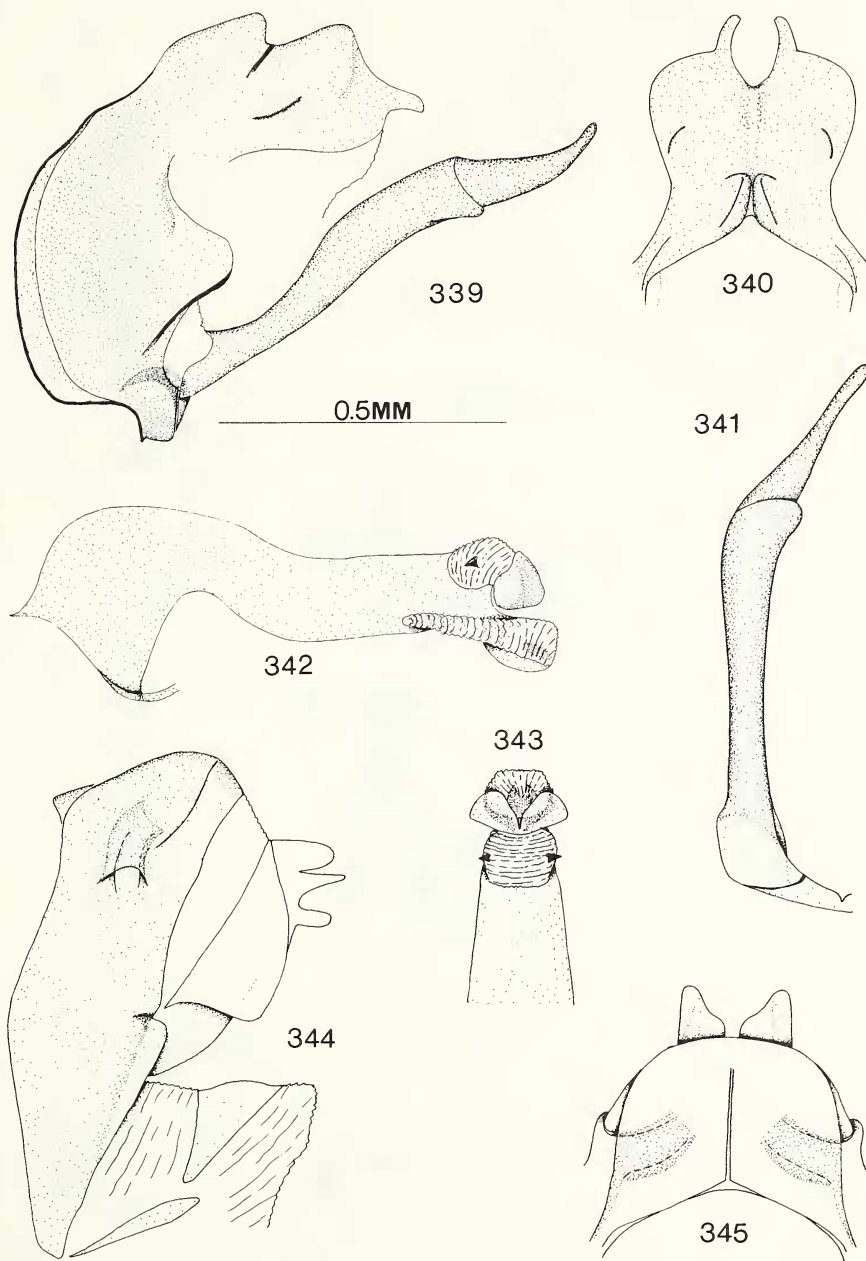


Fig. 339-345, *Hydropsyche piatrix* Ross: 339, genital capsule of male, lateral aspect; 340, genital capsule of male, dorsal aspect; 341, left clasper of male, posterior aspect; 342, aedeagus of male, lateral aspect; 343, aedeagus of male, dorsal aspect of tip; 344, genital segments of female, lateral aspect; 345, genital segments of female, dorsal aspect.

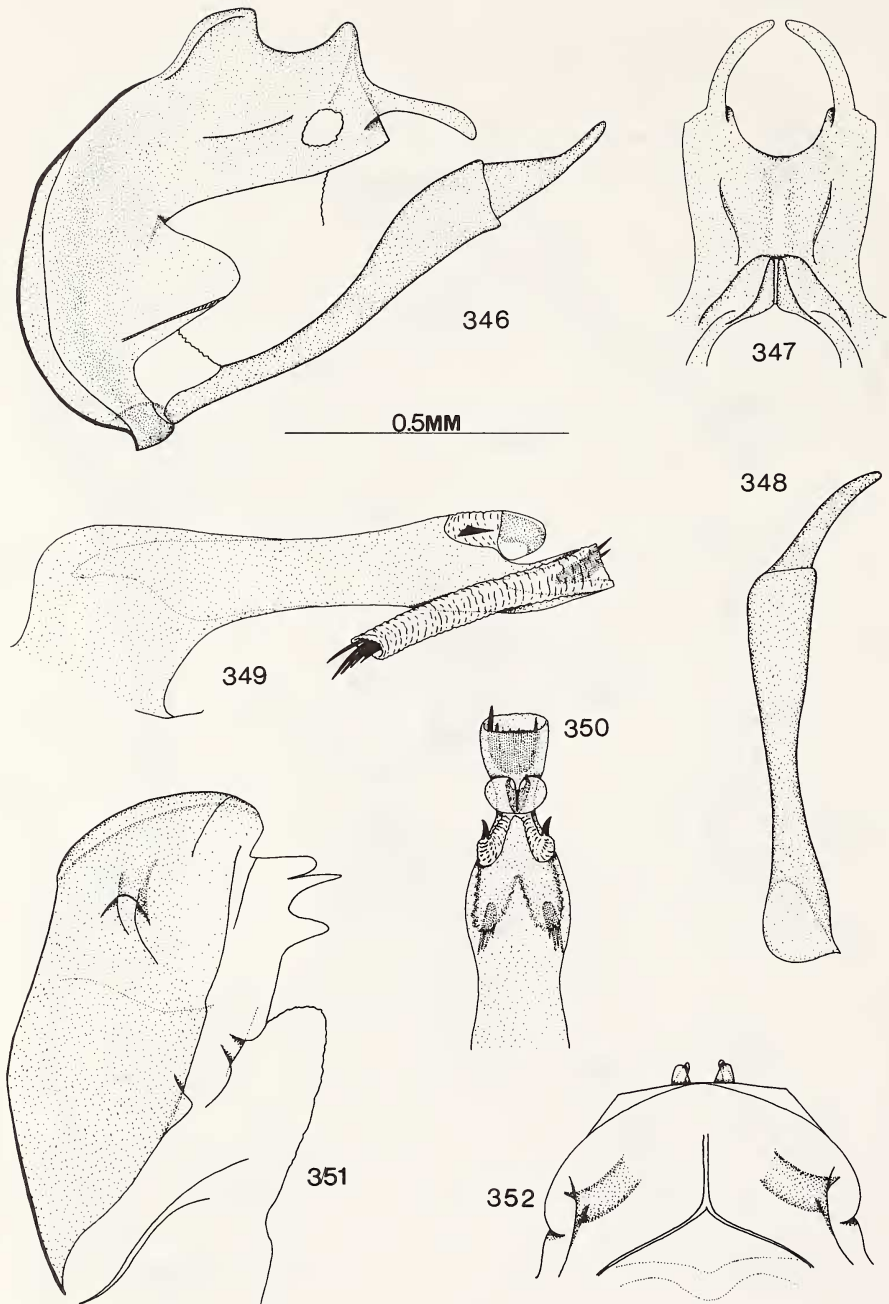


Fig. 346-352, *Hydropsyche vexa* Ross: 346, genital capsule of male, lateral aspect; 347, genital capsule of male, dorsal aspect; 348, left clasper of male, posterior aspect; 349, aedeagus of male, lateral aspect; 350, aedeagus of male, dorsal aspect of tip; 351, genital segments of female, lateral aspect; 352, genital segments of female, dorsal aspect.

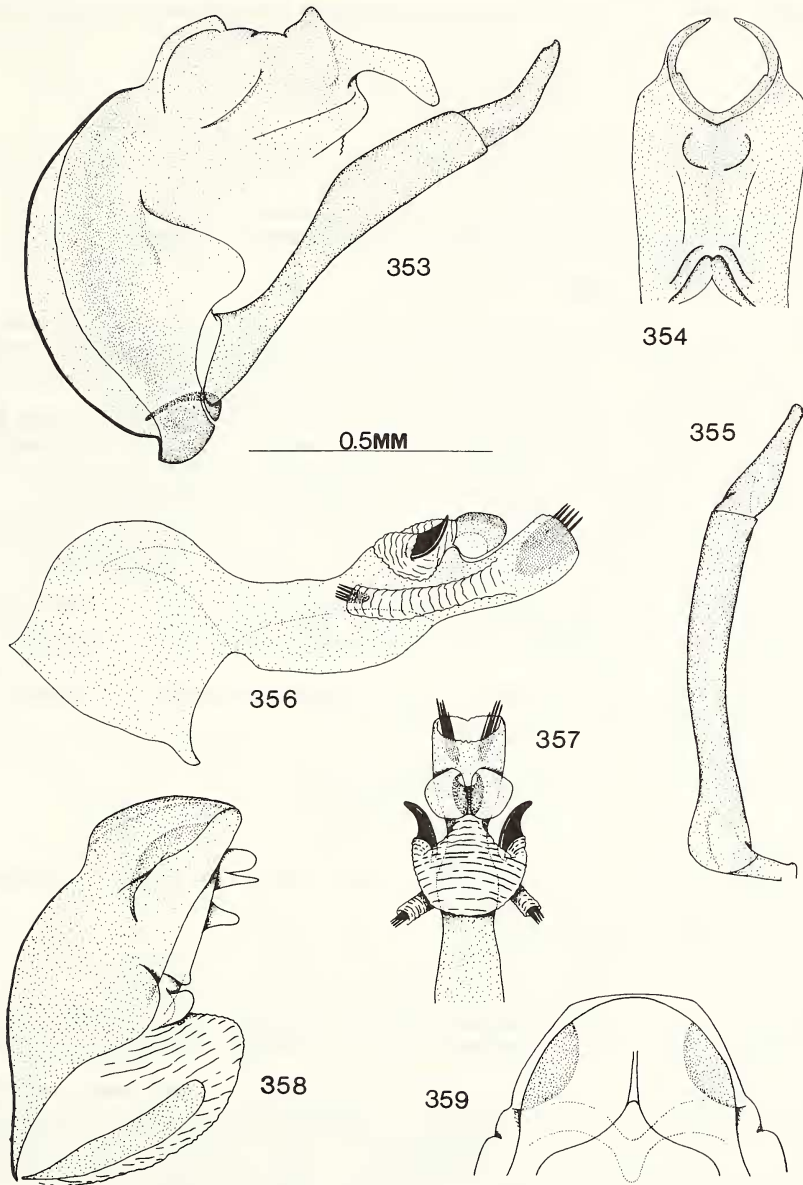


Fig. 353–359, *Hydropsyche walkeri* Betten & Mosely: 353, genital capsule of male, lateral aspect; 354, genital capsule of male, dorsal aspect; 355, left clasper of male, posterior aspect; 356, aedeagus of male, lateral aspect; 357, aedeagus of male, dorsal aspect of tip; 358, genital segments of female, lateral aspect; 359, genital segments of female, dorsal aspect.

## SUBGROUP B

This subgroup characterised by aedeagus without ventro-lateral membranous lobes; distal tooth directed ventrad.

*Hydropsyche alhedra* Ross

Map 57; Fig. 360–366

*Hydropsyche alhedra* Ross, 1939:67; Ross, 1944:294; Schefter, Wiggins, & Unzicker, 1986:69; Schefter & Wiggins, 1986:45.

*Hydropsyche riola* Denning; Schefter, Wiggins, & Unzicker, 1986:69 (as synonym of *H. alhedra*).

*Hydropsyche racona* Denning; Schefter, Wiggins, & Unzicker, 1986:69 (as synonym of *H. alhedra*).

*Symphitopsyche alhedra*; Schuster & Etnier, 1978:45.

See note at end of 'Introduction'.

**Description.**— Male fore-wing length 9.09 mm; pale grey-brown, faintly irrorate posterad of M; female paler. Hind-wing hyaline. Antennae brown; basal seven flagellar annuli each with oblique, dark band; female paler. Vertex dark red-brown, warts paler; female paler. Spurs straw-coloured; mesal member of middle leg apical pair shorter than lateral companion. Thorax dark red-brown, to slightly paler laterally. Legs red-brown; female paler.

**Genitalia.** Male. (Fig. 360-364). (Specimen from St Hippolyte, Québec). Males distinguished by tergum X distal lobes, in dorsal aspect (Fig. 361), very slightly directed mesad; by distal tooth of aedeagus dorsal lobe, in lateral aspect (Fig. 363), with rounded base surmounted by much narrower rounded spine – not visible in dorsal aspect (Fig. 364); and by lateral lobe on posterior edge of segment IX set very low, connected to dorsum of segment by thin, dark line.

**Genitalia.** Female. (Fig. 365-366). (Specimen from St Hippolyte, Québec). Females distinguished by clasper receptacle directed dorsad in lateral aspect (Fig. 365), directed mesad in dorsal aspect (Fig. 366); by dorsal and ventral lobes, and cerci of segment XI very close; and by sclerotised strap of vulval scale long, not wide distally, sinuate.

**Biology.**— Larvae apparently inhabit rapids sections of smaller, cool, clear streams (Schuster & Etnier, 1978). Emergence in April. Few Canadian flight records range from June 5 to August 29.

**Distribution.**— Very scattered (Map 57), with isolated records from Tennessee, North Carolina, to Pennsylvania, Québec, and southern Manitoba.

*Hydropsyche bifida* Banks

Map 58; Fig. 367–373

*Hydropsyche bifida* Banks, 1905a:15; Betten, 1934:193; Milne, 1936:73; Denning, 1943:129; Ross, 1944:97; Schefter & Unzicker, 1984:331 (as synonym of *H. morosa*).

*Symphitopsyche bifida*; Schuster & Etnier, 1978:30.

See note at end of 'Introduction'.

**Description.**— Male fore-wing length 8.03 mm; pale golden brown, faintly irrorate. Antennae brownish yellow; basal nine flagellar annuli each with oblique, dark band. Vertex yellow-brown. Spurs straw-coloured; lateral member of middle and hind-leg pairs notably shorter than mesal companions; not so in female. Thorax yellow-brown. Legs yellow, to pale straw.

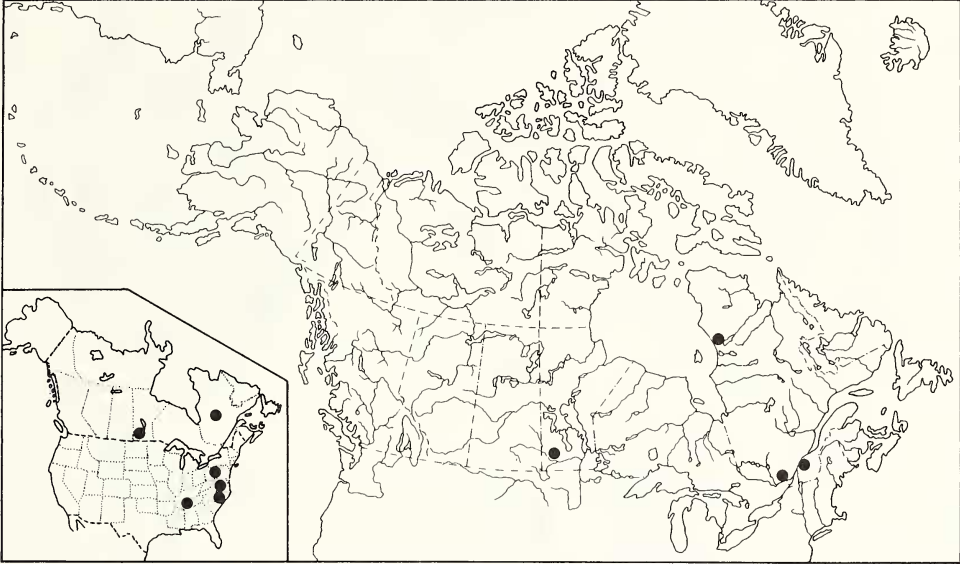
**Genitalia.** Male. (Fig. 367–371). (Specimen from Blindman R., Hwy 2, Ponoka, Alberta). Males distinguished by tergum X distal lobes set high on distal end of tergum, thin, almost pointed distally, curved slightly ventrad, in lateral aspect (Fig. 367); by basal article of clasper slender, especially at base, crooked in lateral aspect; by distal article of clasper with base as wide as basal article, then sharply tapered to distal half which is of even width, narrow, rounded distally; and by tooth of dorsal lobe of aedeagus curved slightly ventrad, small, clothed in minute dentitions.

**Genitalia.** Female. (Fig. 372–373). (Specimen from Blindman R., Hwy 2, Ponoka, Alberta). Females distinguished by clasper receptacle curved antero-dorsad in lateral aspect (Fig. 372), meso-posterad in dorsal aspect (Fig. 373); by mouth of receptacle with one groove on floor; and by cerci closer to dorsal lobe of segment XI than to ventral lobe.

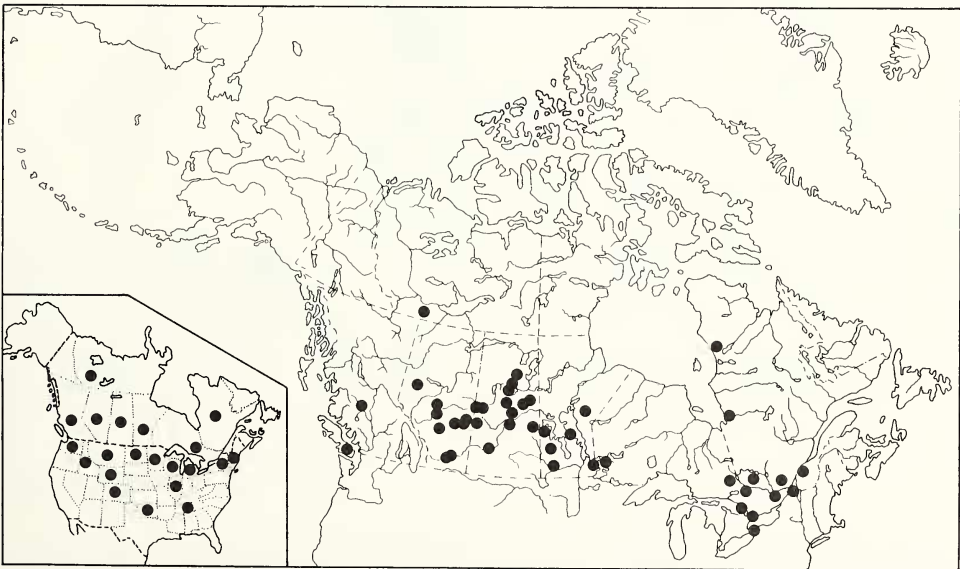
**Biology.**— Larvae commonly collected in medium-sized creeks or small rivers with coarse gravel or small rock substrates, and high organic loading. Canadian flight season extends from May 22 to October 16, with bulk of records in June-July.



*Distribution.*— Widely distributed, from Great Slave Lk. and central British Columbia to Oklahoma, Tennessee, Vermont, and Québec (Map 58). In Canada, well recorded across Prairie Provinces, sparsely in British Columbia, north to near Great Slave Lk. In the east, it is known from western and southern Québec, and southern Ontario.



Map 57. Collection localities for *Hydropsyche alhedra* Ross in Canada, with known distribution in North America by state or province.



Map 58. Collection localities for *Hydropsyche bifida* Banks in Canada, with known distribution in North America by state or province.

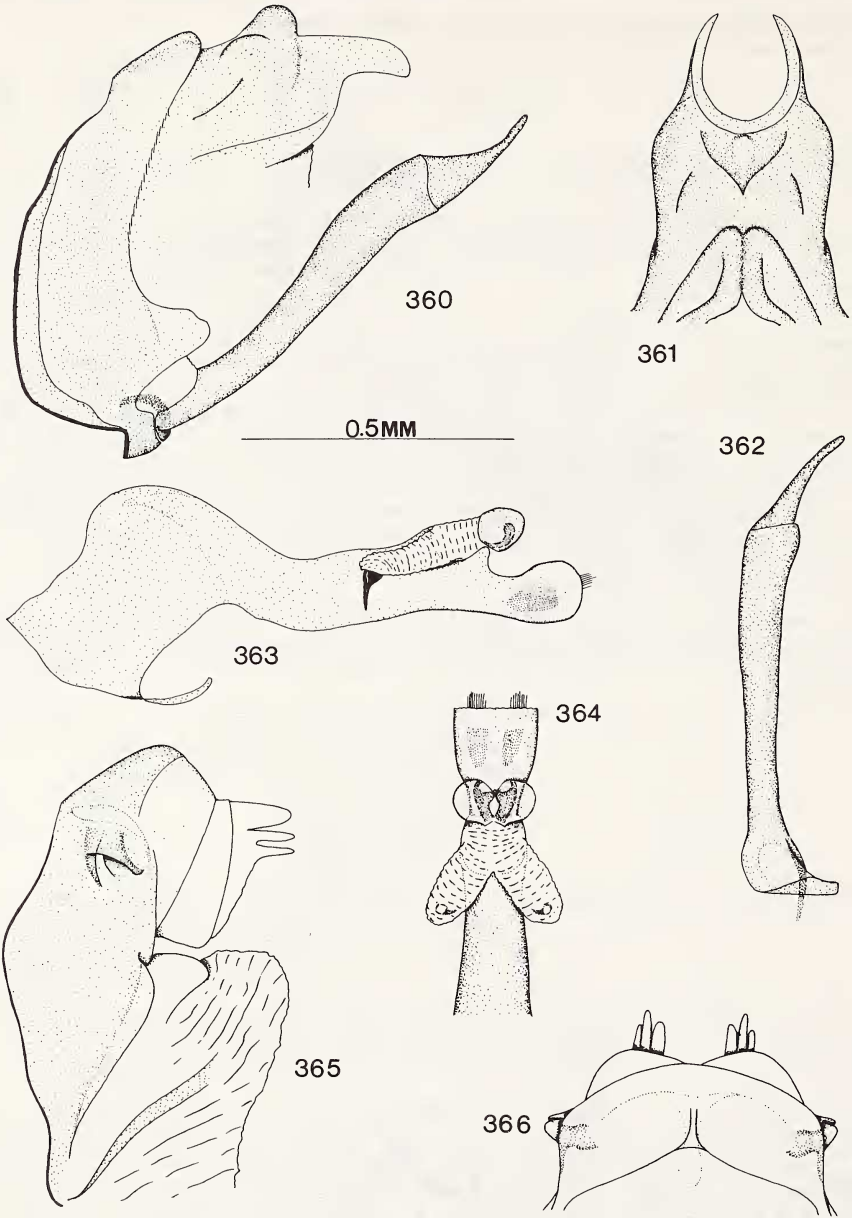


Fig. 360–366. *Hydropsyche alhedra* Ross: 360, genital capsule of male, lateral aspect; 361, genital capsule of male, dorsal aspect; 362, left clasper of male, posterior aspect; 363, aedeagus of male, lateral aspect; 364, aedeagus of male, dorsal aspect of tip; 365, genital segments of female, lateral aspect; 366, genital segments of female, dorsal aspect.

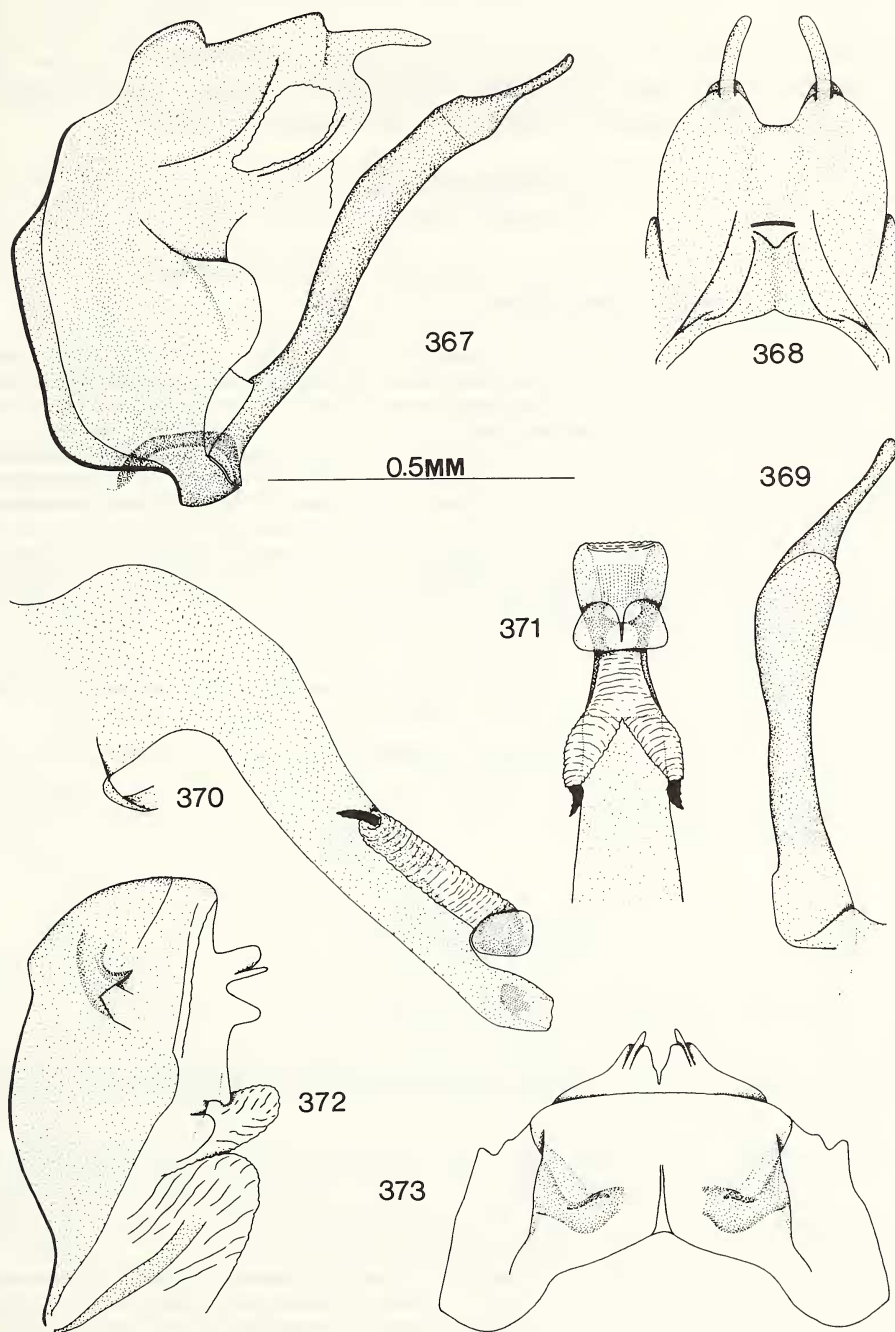


Fig. 367-373, *Hydropsyche bifida* Banks: 367, genital capsule of male, lateral aspect; 368, genital capsule of male, dorsal aspect; 369, left clasper of male, posterior aspect; 370, aedeagus of male, lateral aspect; 371, aedeagus of male, dorsal aspect of tip; 372, genital segments of female, lateral aspect; 373, genital segments of female, dorsal aspect.

## SUBGROUP C

This group characterised by aedeagus not only with dorsal membranous lobes, but also with ventro-lateral lobes short, restricted to extreme distal portion of aedeagus; these lobes reduced in some species to simple, unsclerotised apertures laterally on aedeagus extremity.

*Hydropsyche bronta* Ross

Map 59; Fig. 374–380

*Hydropsyche bronta* Ross, 1938b:149; Denning, 1943:125; Ross, 1944:98; Schefter & Wiggins, 1986:52.

*Symphitopsyche (Ceratopsyche) bronta*; Ross & Unzicker, 1977:305.

*Symphitopsyche bronta*; Schuster & Etnier, 1978:37.

**Description.**— Male fore-wing length 7.29 mm; pale grey-brown, faintly irrorate; female pale orange-brown. Antennae brownish cream; apparently without oblique, dark bands in male; basal seven flagellar annuli of female each with faint, oblique, darker band. Spurs yellow-brown; lateral member of middle leg pairs notably shorter than mesal companions. Thorax and legs bright, pale yellow-brown overall.

**Genitalia.** Male. (Fig. 374–378). (Specimen from Carrot Ck, Hwy 16, Alberta). Males distinguished by distal article of clasper, in lateral aspect (Fig. 374), triangular, apex slightly drawn out; by tergum X distal lobes short in lateral aspect (Fig. 374), curved ventrad; by these lobes, in dorsal aspect (Fig. 375), short, linear, not convergent; and by dorsal lobe of aedeagus with large, stout, linear, distally acuminate distal tooth or spine directed antero-ventrad (Fig. 377).

**Genitalia.** Female. (Fig. 379–380). (Specimen from Ile Ste Hélène, St Lawrence R., Montréal, Québec). Females distinguished by clasper receptacle small, directed antero-dorsad in lateral aspect (Fig. 379), with outer margin of receptacle continued dorsad and ventrad by thin, dark lines; by inner opening of receptacle clearly evident in lateral aspect; and by receptacle, in dorsal aspect (Fig. 380), directed mesad.

**Biology.**— I have taken adults from a great variety of small creeks to medium-sized rivers, some cool, others warm, some clear, turbulent, others slow, weedy. Flight season ranges from May 25 to September 2, in Canada, with concentration of records in June and early July.

**Distribution.**— Widespread from Alberta and Wyoming, to South Carolina and Nova Scotia (Map 59). In Canada this species commonly recorded from Alberta lower foothills to eastern Québec, New Brunswick, and Nova Scotia, northward into southern reaches of Boreal Forest.

*Hydropsyche cheilonis* Ross

Map 60; Fig. 381–387

*Hydropsyche cheilonis* Ross, 1938b:149; Ross, 1944:98; Schefter & Wiggins, 1986:57.

*Symphitopsyche cheilonis*; Schuster & Etnier, 1978:33.

**Description.**— Male fore-wing length 7.80 mm; light purple-brown, slight irroration along A. Hind-wing tinted grey-brown. Antennae yellow; no banding on annuli. Vertex dark brown anteriorly, yellow posteriorly, warts dark brown. Spurs grey-brown; lateral member of fore- and hind-leg pairs shorter than mesal companions. Thorax mottled grey-brown and yellow-brown. Legs grey-brown to dull straw.

**Genitalia.** Male. (Fig. 381–385). (Specimen from Crossville, Cumberland Co., Tennessee, USA). Males distinguished by basal article of clasper, in lateral aspect (Fig. 381), sinuate, distal quarter wider than remainder; by distal article of clasper with triangular base, with apex drawn out to finger-like process; by tergum X distal lobes, in dorsal aspect (Fig. 382), angled slightly mesad, linear; and by dorsal lobe of aedeagus with long, thin tooth or spine distally – tooth angled slightly ventrad at mid-point (Fig. 384), slightly expanded distally in dorsal aspect (Fig. 385).

**Genitalia.** Female. (Fig. 386–387). (Specimen from Beaver Ck, Knox Co., Tennessee, USA). Females distinguished by vulval scale with thin, curved primary sclerotised strap, and irregular, formless secondary sclerite laterally (Fig. 386); by clasper receptacle, in lateral aspect (Fig. 386), curved dorso-posterad, with two grooves on floor of outer opening; and by receptacle, in dorsal aspect (Fig. 387), curved meso-posterad.

**Biology.**— Larvae seem to prefer small to medium-sized, warm-water streams of slow current and large riffle areas. Emergence from early April to September.

*Distribution*.— Not yet known from Canada. Presently known from Wisconsin to Tennessee and Virginia (Map 60).

*Hydropsyche morosa* Hagen

Map 61; Fig. 388–394

*Hydropsyche morosa* Hagen, 1861:287; Milne, 1936:71, 73; Denning, 1943:127; Ross, 1944:98; Wiggins, 1977:106; Scheffer & Unzicker, 1984:331; Scheffer & Wiggins, 1986:62.

*Hydropsyche chlorotica* Hagen, 1861:290; Ross, 1938c:16 (as synonym of *H. morosa*).

*Symphitopsyche morosa*; Schuster & Etnier, 1978:41.

See note at end of 'Introduction'.

*Description*.— Male fore-wing length 9.63 mm; pale yellow-brown, faintly irrorate distally and along distal third of R1. Hind-wing hyaline. Antennae brown; with dark bands at each end of flagellar annuli. Vertex brown. Spurs brown. Thorax red-brown, to paler laterally. Legs light yellow-brown.

*Genitalia*. Male. (Fig. 388–392). (Specimen from Ile Ste Hélène, St Lawrence R., Montréal, Québec). Males distinguished by distal article of clasper, in lateral aspect (Fig. 388), with wide base which supports long, finger-like distal process; by tergum X distal lobes, in dorsal aspect (Fig. 389), well separated, gently curved, thin, distally rounded; and by dorsal lobe of aedeagus with massive distal tooth, dorsal edge of which is spinate.

*Genitalia*. Female. (Fig. 393–394). (Specimen from Huberdeau, Québec). Females distinguished by clasper receptacle, in lateral aspect (Fig. 393), linear, directed dorso-anterad; by outer opening of receptacle with two lobes on floor of opening; and by receptacle, in dorsal aspect (Fig. 394), directed mesad.

*Biology*.— Apparently a species of medium-sized rivers with large riffle areas of small to medium rocks clothed in weed. Canadian flight season extends from May 16 to September 21.

*Distribution*.— Known from Cape Breton Island, Nova Scotia, west to Alberta, south to Tennessee (Map 61). In Canada the species is known from southern Ontario and Québec, with scattered records to north and west.

*Hydropsyche slossonae* Banks

Map 62; Fig. 395–401

*Hydropsyche slossonae* Banks 1905a:14; Betten, 1934:185 (as synonym of *H. alternans*); Milne, 1936:69, 72, 73; Denning, 1943:131; Ross, 1944:99; Scheffer & Wiggins, 1986:70.

*Symphitopsyche slossonae*; Schuster & Etnier, 1978:47.

*Description*.— Male fore-wing length 9.36 mm; grey-brown, more or less irrorate. Antennae yellow-brown; basal seven flagellar annuli each with oblique, dark band; five in female. Vertex brown anteriorly, to pale yellow-brown posteriorly; dark brown with white warts in female. Spurs yellow; lateral member of middle leg pairs notably shorter than mesal companions. Thorax brown, to brownish yellow laterally; dark brown to grey-brown laterally in female. Legs pale brown, except hind-legs pale straw; uniform yellow-brown in female.

*Genitalia*. Male. (Fig. 395–399). (Specimen from Rapids Ck, Trans-Canada Hwy, Gap, Alberta). Males distinguished by massive distal lobes of tergum X, in lateral aspect (Fig. 395), tapered rather abruptly in distal half; by these lobes, in dorsal aspect (Fig. 396), lyre-like; and by dorsal lobe of aedeagus small, abruptly tapered anterad, with minute distal tooth (Fig. 398).

*Genitalia*. Female. (Fig. 400–401). (Specimen from creek, Hwy 932, 6 miles S of Whitecourt, Alberta). Females distinguished by clasper receptacle, in lateral aspect (Fig. 400), oriented vertically, curved dorso-posterad distally, with two grooves on floor of outer opening; and by dorsal and ventral lobes of segment XI, and cerci, all visible in dorsal aspect (Fig. 401).

*Biology*.— A species of cold-water streams; little more known of larval habitat preferences. Canadian flight records range from June 6 to September 5, with peak of sorts in late June and July.

*Distribution*.— Widespread from eastern seaboard of North America to northwestern North America (Great Slave Lake and central British Columbia) (Map 62). Recorded in Canada from Newfoundland to Great Slave Lk, central British Columbia, south to United States border.

*Hydropsyche tana* Ross

Map 63; Fig. 402–408

*Hydropsyche tana* Ross, 1938b:151; Ross, 1944:294; Scheffter & Wiggins, 1986:77.

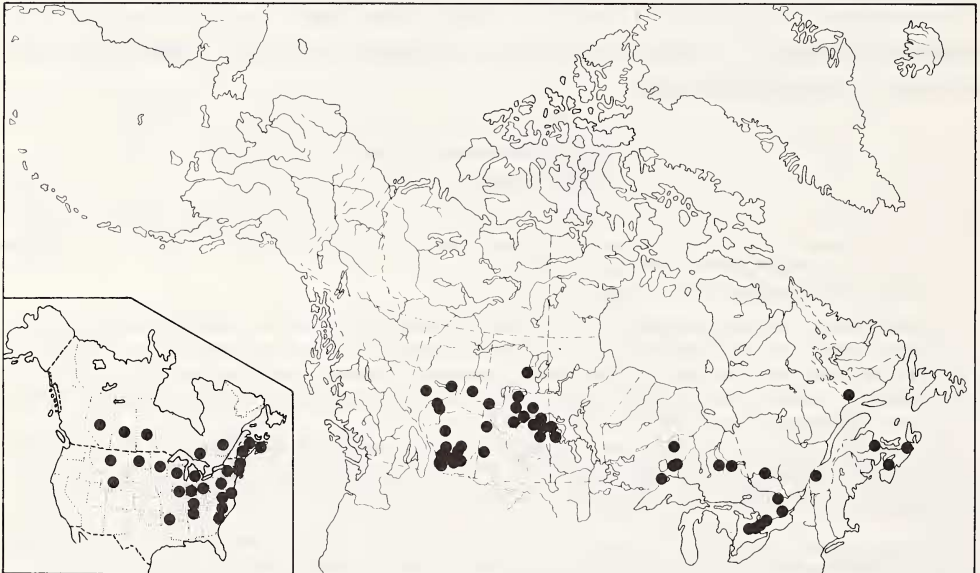
**Description.**— Male fore-wing length 8.42 mm; grey-brown, fairly uniformly irrorate. Antennae brownish straw; basal seven flagellar annuli each with oblique, dark band. Vertex dark brown, posterior warts paler. Spurs yellow; lateral member of middle and hind-leg pairs much shorter than mesal companions. Thorax dark brown, to grey-brown laterally. Legs straw-coloured.

**Genitalia.** Male. (Fig. 402–406). (Specimen from creek, Hwy 37, 92 km N of Kitwanga, British Columbia). Males distinguished by tergum X distal lobes, in lateral aspect (Fig. 402), massive, with narrower tip directed postero-ventrad; by these lobes, in dorsal aspect (Fig. 403), curved postero-mesad; by distal article of clasper tapered slightly distad, with dorsal edge of tip scalloped (Fig. 402); and by dorsal lobe of aedeagus (Fig. 405) with tooth (wide-based, with distal spine) directed postero-laterad (Fig. 406).

**Genitalia.** Female. (Fig. 407–408). (Specimen from Teton R., Teton Co., Idaho, USA). Females distinguished by clasper receptacle minute, set very high on lateral wall of segment X (Fig. 407); and by outer margin of receptacle bowed distinctly ventrad.

**Biology.**— Nothing known, except known flight dates range from July 1 to 16.

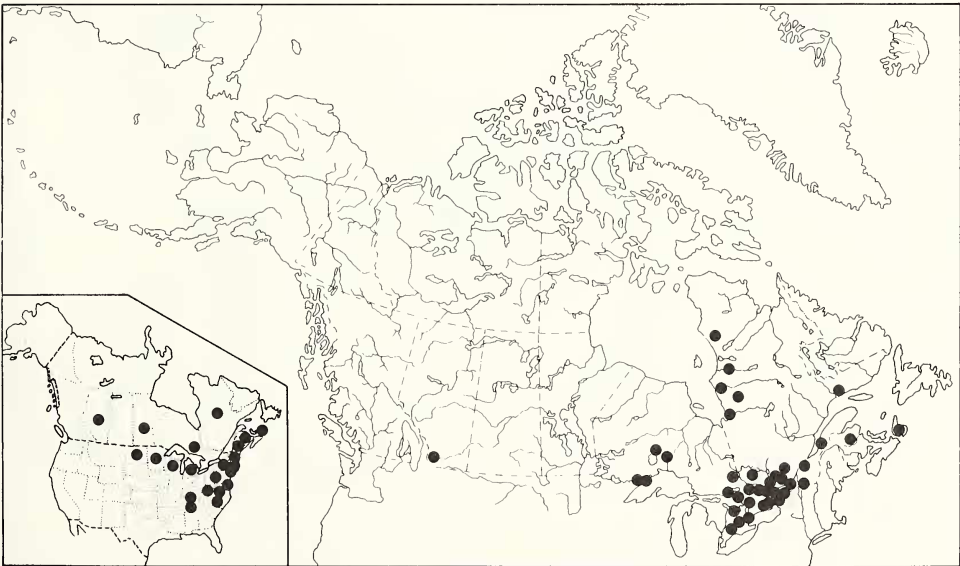
**Distribution.**— Presently known only from western Montana, Idaho, British Columbia, and Vancouver Island (Map 63). In Canada, recorded from just north of Skeena R., southern Vancouver Island, and interior British Columbia.



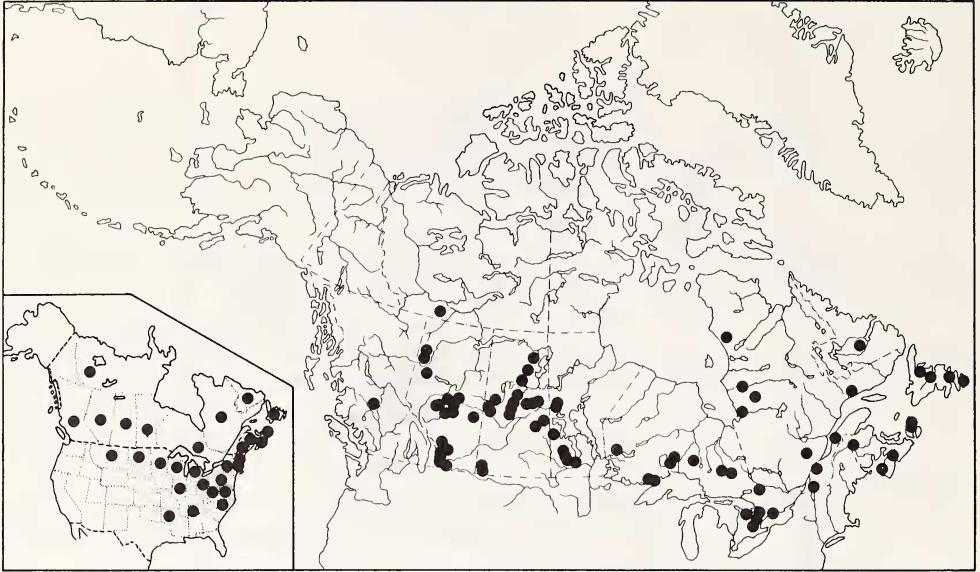
Map 59. Collection localities for *Hydropsyche bronta* Ross in Canada, with known distribution in North America by state or province.



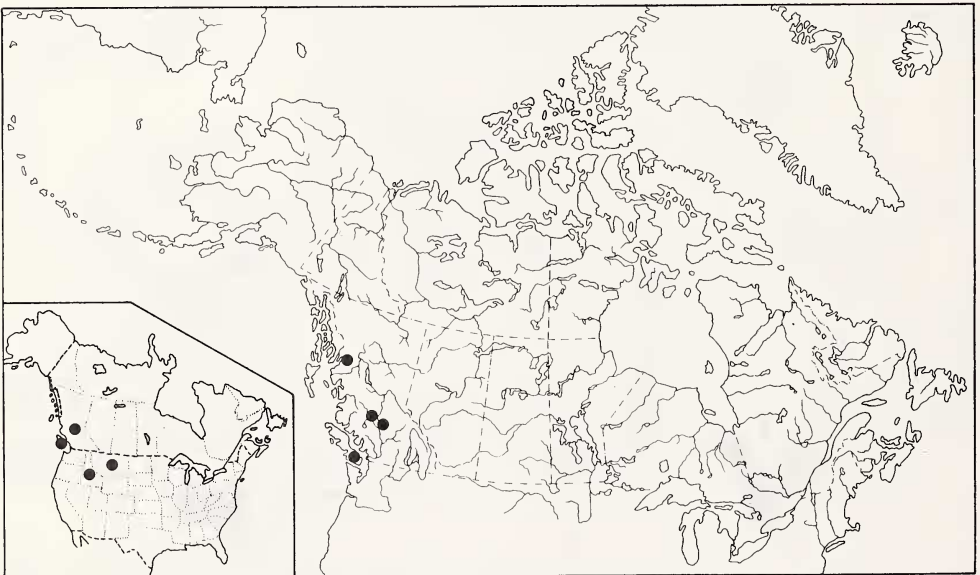
Map 60. Known distribution of *Hydropsyche cheilonis* Ross in North America, by state.



Map 61. Collection localities for *Hydropsyche morosa* Hagen in Canada, with known distribution in North America by state or province.



Map 62. Collection localities for *Hydropsyche slossonae* Banks in Canada, with known distribution in North America by state or province.



Map 63. Collection localities for *Hydropsyche tana* Ross in Canada, with known distribution in North America by state or province.



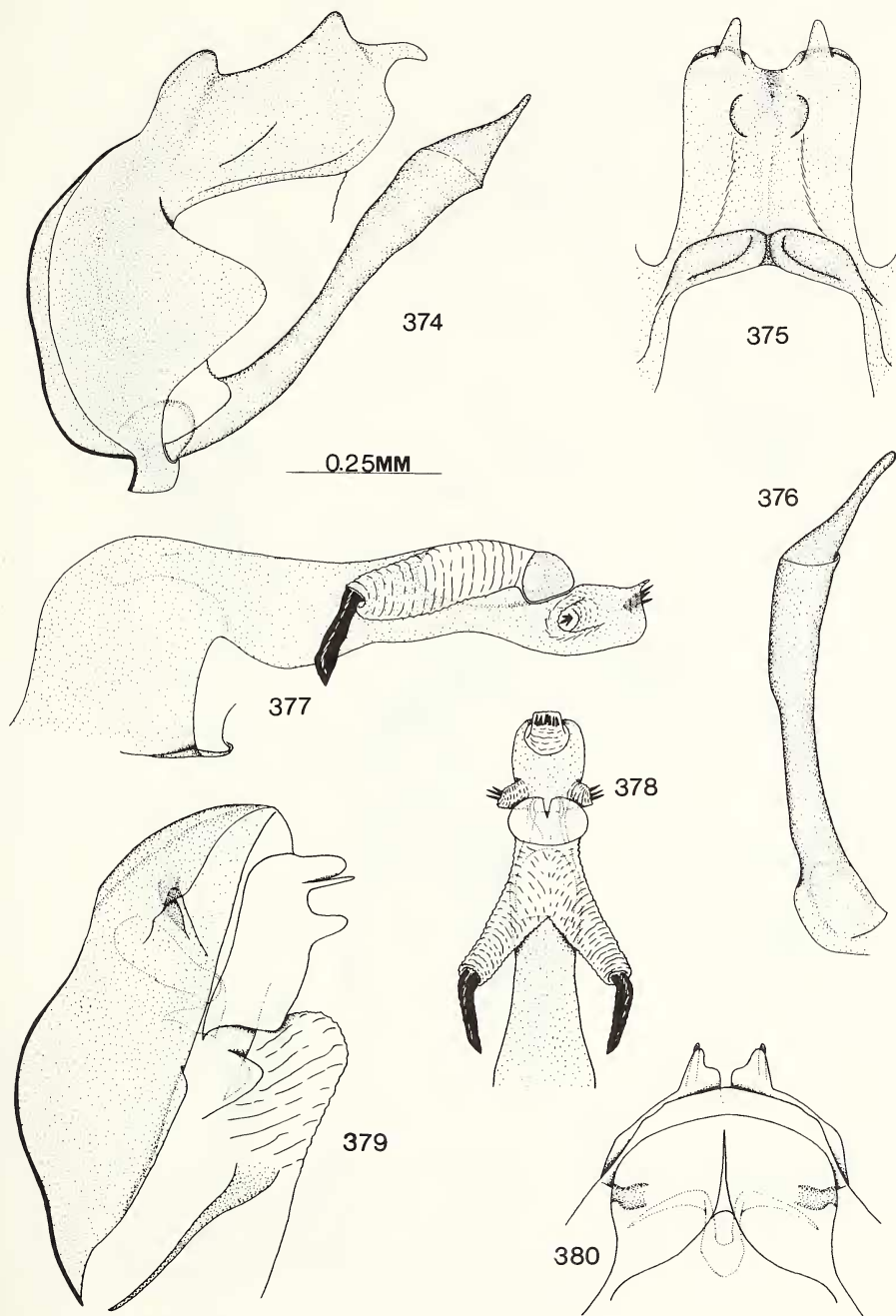


Fig. 374–380, *Hydropsyche bronta* Ross: 374, genital capsule of male, lateral aspect; 375, genital capsule of male, dorsal aspect; 376, left clasper of male, posterior aspect; 377, aedeagus of male, lateral aspect; 378, aedeagus of male, dorsal aspect of tip; 379, genital segments of female, lateral aspect; 380, genital segments of female, dorsal aspect.

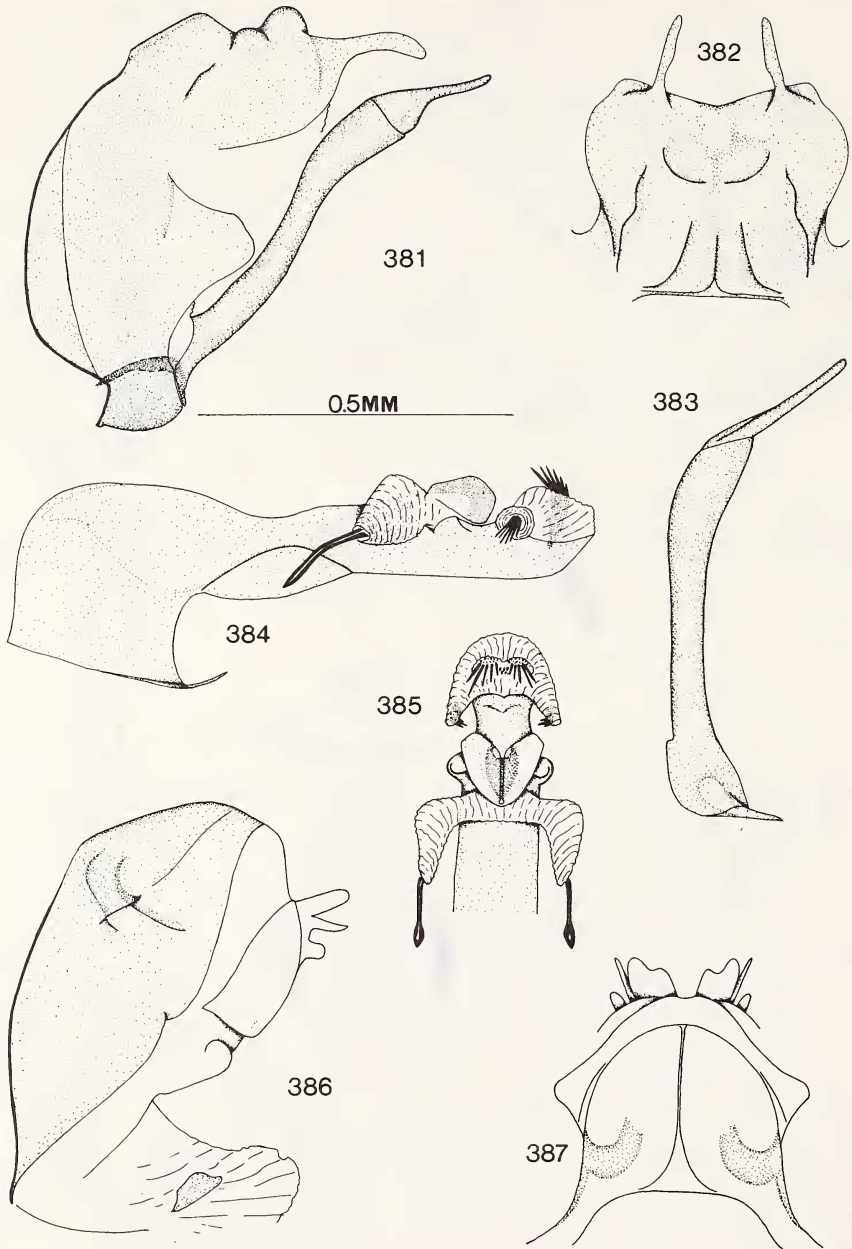


Fig. 381–387, *Hydropsyche cheilonis* Ross: 381, genital capsule of male, lateral aspect; 382, genital capsule of male, dorsal aspect; 383, left clasper of male, posterior aspect; 384, aedeagus of male, lateral aspect; 385, aedeagus of male, dorsal aspect of tip; 386, genital segments of female, lateral aspect; 387, genital segments of female, dorsal aspect.

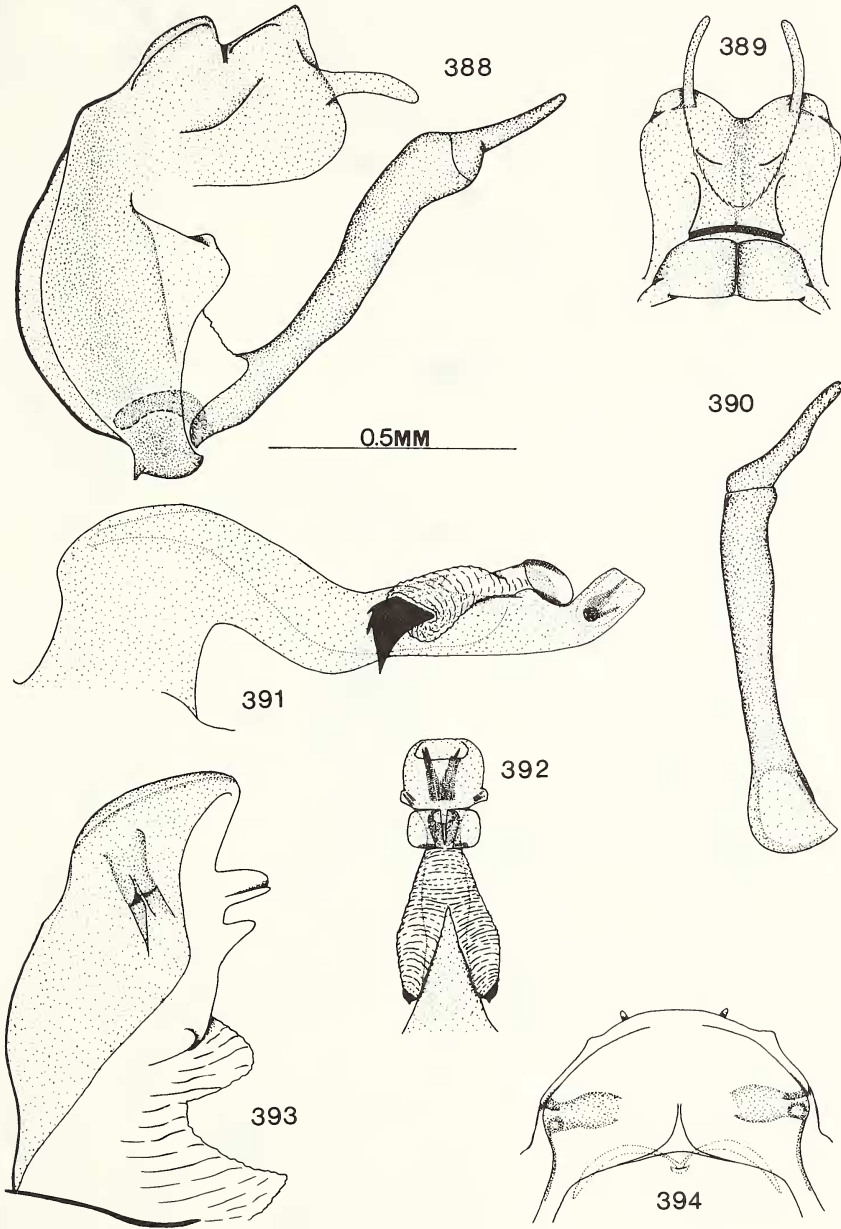


Fig. 388-394, *Hydropsyche morosa* Hagen: 388, genital capsule of male, lateral aspect; 389, genital capsule of male, dorsal aspect; 390, left clasper of male, posterior aspect; 391, aedeagus of male, lateral aspect; 392, aedeagus of male, dorsal aspect of tip; 393, genital segments of female, lateral aspect; 394, genital segments of female, dorsal aspect.

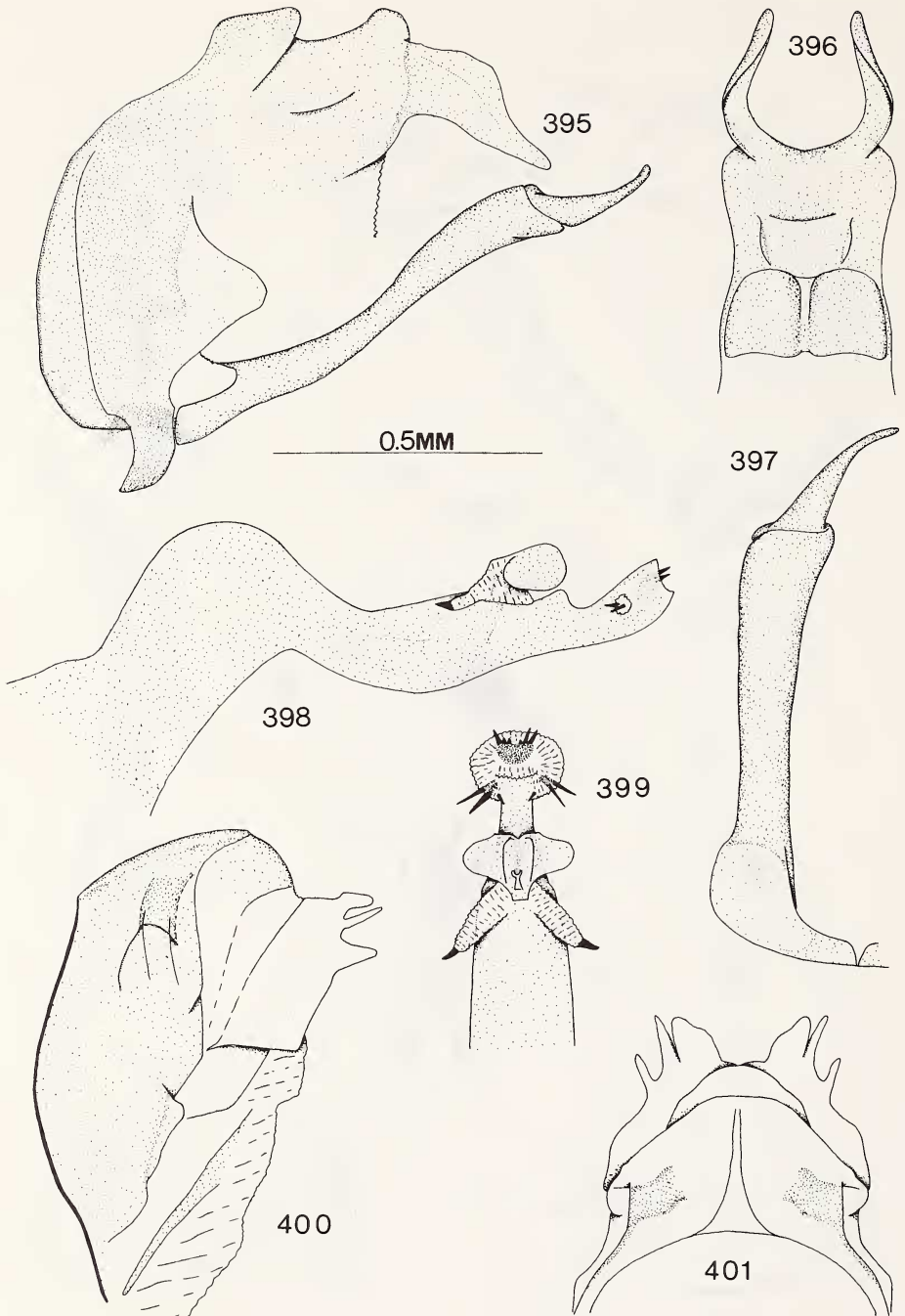


Fig. 395-401, *Hydropsyche slossonae* Banks: 395, genital capsule of male, lateral aspect; 396, genital capsule of male, dorsal aspect; 397, left clasper of male, posterior aspect; 398, aedeagus of male, lateral aspect; 399, aedeagus of male, dorsal aspect of tip; 400, genital segments of female, lateral aspect; 401, genital segments of female, dorsal aspect.

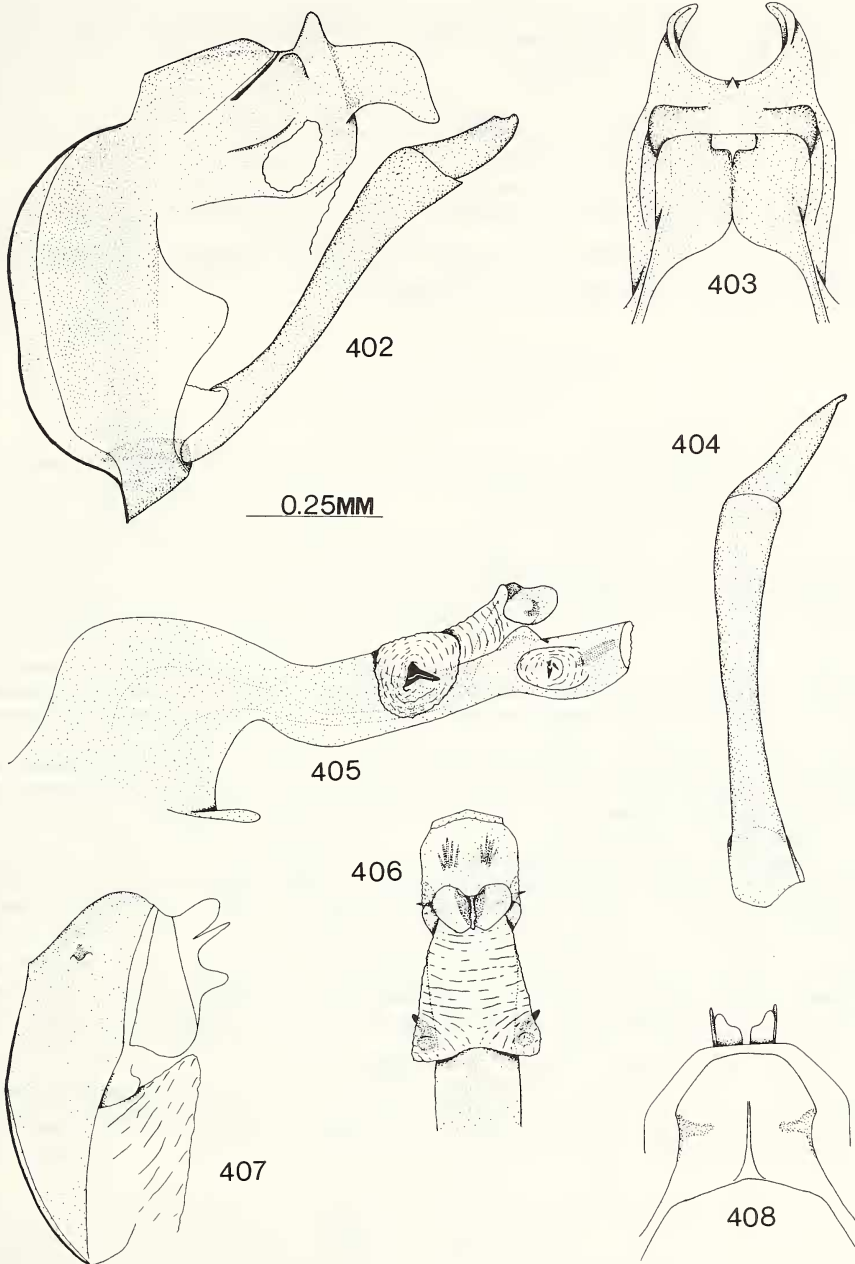


Fig. 402-408, *Hydropsyche tana* Ross: 402, genital capsule of male, lateral aspect; 403, genital capsule of male, dorsal aspect; 404, left clasper of male, posterior aspect; 405, aedeagus of male, lateral aspect; 406, aedeagus of male, dorsal aspect of tip; 407, genital segments of female, lateral aspect; 408, genital segments of female, dorsal aspect.

## SUBGROUP D

This group characterised by aedeagus with dorsal membranous lobes only, distal teeth, or spines, of which are curved antero-dorsad.

*Hydropsyche aenigma* Schefter, Wiggins, & Unzicker

*Hydropsyche aenigma* Schefter, Wiggins, & Unzicker, 1986:78; Schefter & Wiggins, 1986:44.

This species, described from New York State in 1986, is very close to *H. alternans* (Walker) and *H. centra* Ross. Time constraints precluded inclusion of illustrations here, but comparative illustrations of all three species are given by the authors.

*Hydropsyche alternans* (Walker)

Map 64; Fig. 409–415

*Philopotamus alternans* Walker, 1852:104.

*Hydropsyche alternans*; Vorhies, 1909:707 (sp. indet.); Betten, 1934:185 (prob. *H. bifida*); Nimmo, 1981:261 (*H. recurvata* as synonym); Schefter & Wiggins, 1986:48.

*Hydropsyche slossonae* var. *recurvata* Banks, 1914:253.

*Hydropsyche recurvata*; Betten, 1934:190; Milne, 1936:73 (as synonym of *H. slossonae*); Denning, 1943:126; Ross, 1944:99; Schmid, 1980:Fig. 131-140; Nimmo, 1981:261 (as synonym of *H. alternans*).

*Symphitopsyche recurvata*; Schuster & Etnier, 1978:34.

*Hydropsyche codona* Betten, 1934:187; Milne, 1936:73 (as synonym of *H. slossonae*); Ross, 1938c:18 (as synonym of *H. recurvata*).

**Description.**— Male fore-wing length 9.44 mm; grey-brown, clearly irrorate. Hind-wing faintly tinted brown. Antennae pale brown; basal eight flagellar annuli each with oblique, dark band. Vertex dark brown anteriorly, yellow-brown posteriorly. Spurs pale yellow-brown, to straw; lateral member of middle leg pairs notably shorter than mesal companions. Thorax dark brown, to paler laterally.

**Genitalia.** Male. (Fig. 409–413). (Specimen from Wandering R., Hwy 63, Wandering River, Alberta). Males distinguished by distal article of clasper, in posterior aspect (Fig. 411), acute-triangular; by small, membranous, dorsally directed lobe located dorsally on aedeagus, between two dorsal lobes (Fig. 412); and by tergum X distal lobes narrow, well separated, acuminate, in dorsal aspect (Fig. 410).

**Genitalia.** Female. (Fig. 414–415). (Specimen from Wandering R., Hwy 63, Wandering River, Alberta). Females distinguished by clasper receptacle, in lateral aspect (Fig. 414), directed antero-dorsad, like inverted vase due to swelling; by outer opening of receptacle with two grooves on floor; and by receptacle, in dorsal aspect (Fig. 415), directed antero-mesad.

**Biology.**— Commonly collected from fast, cold waters, but known from warmer waters also. Known from small creeks, to largest rivers, suggesting wide tolerance of habitat types. Ross (1944) also records larvae from wave-washed shores of large lakes. Flight season ranges from May 8 to October 16 in Canada, with peak in June/July.

**Distribution.**— Very widespread, known from Alaska to Newfoundland, south to southern British Columbia, St Lawrence R. valley in Canada, and to most states in United States, about the Great Lakes (Map 64).

*Hydropsyche centra* Ross

Map 65; Fig. 416–422

*Hydropsyche centra* Ross, 1938b:150; Ross, 1944:294; Anderson, 1976:66; Schefter & Wiggins, 1986:55.

**Description.**— Male fore-wing length 9.36 mm; uniform pale yellowish brown, faintly irrorate posterad of Cu1+2; irroration not evident in females seen. Hind-wing hyaline; pale reddish brown in female. Antennae pale yellow-brown; basal seven flagellar annuli each with oblique, dark band. Vertex almost black, warts paler; dark red-brown to chocolate in female. Spurs pale yellow-brown; lateral member of middle leg pairs shorter than mesal companions. Thorax very deep red-brown, to paler laterally. Legs pale yellow to straw.

*Genitalia.* Male. (Fig. 416–420). (Specimen from Leaburg Dam, Mackenzie R., Lake Co., Oregon, USA). Males distinguished by lobe on postero-ventral edge of segment IX long, rounded distally (Fig. 416); by tergum X distal lobes, in dorsal aspect (Fig. 417), curved mesad with oval gap between lobes; and by teeth or spines of dorsal lobes of aedeagus, in lateral aspect (Fig. 419), large, with short, straight base, with distal portion long, curved antero-dorsad from base, acuminate.

*Genitalia.* Female. (Fig. 421–422). (Specimen from Lakelse, 18 miles of S Terrace, British Columbia). Females distinguished by small clasper receptacle, in lateral aspect (Fig. 421), directed dorsad, distally rounded, without inner opening visible; and by receptacle, in dorsal aspect (Fig. 422), directed meso-anterad.

*Biology.*— Little known. Flight season records for Oregon (Anderson, 1976) range from late April to late September, with peak in May/June. The few Canadian records fall within this range.

*Distribution.*— Presently known only from Oregon, Washington, British Columbia, Vancouver Island (Map 65). In British Columbia the species has been recorded as far north as Skeena R. basin.

### *Hydropsyche cockerelli* Banks

Map 66; Fig. 423–429

*Hydropsyche cockerelli* Banks, 1905a:14; Betten, 1934:193; Milne, 1936:70, 71, 73; Ross, 1944:294; Schefter, Wiggins, & Unzicker, 1986:73; Schefter & Wiggins, 1986:58.

See note at end of 'Introduction'.

*Description.*— Male fore-wing length 8.74 mm; pale greyish brown, faintly irrorate; female more orange-brown. Hind-wing faintly tinted brown. Antennae pale yellow-brown; basal eight flagellar annuli each with oblique, dark band. Vertex dark brown. Lateral member of middle and hind-leg spur pairs rather shorter than mesal companions. Thorax dark reddish brown, to brown laterally. Legs yellowish cream.

*Genitalia.* Male. (Fig. 423–427). (Specimen from Waterton R., Hwy 5, Alberta). Males distinguished by tergum X distal lobes, in lateral aspect (Fig. 423), directed postero-dorsad, with disto-dorsal angle produced as rounded, triangular point; by these lobes, in dorsal aspect (Fig. 424), curved postero-laterad; and by distal article of clasper, in lateral aspect (Fig. 423), skewed acute-triangular, with tip hooked slightly dorsad.

*Genitalia.* Female. (Fig. 428–429). (Specimen from Waterton R., Hwy 5, Alberta). Females distinguished by very small clasper receptacle, in lateral aspect (Fig. 428), directed dorso-anterad, with outer margin located at mid-point of receptacle; by receptacle, in dorsal aspect (Fig. 429), directed sharply anterad; and by sclerotised strap of vulval scale large, widest at two-thirds distance from proximal end.

*Biology.*— Larvae seem to exhibit wide latitude in choice of habitat. Recorded from small, sluggish prairie streams, from very large cordilleran rivers, and all sizes of foothills streams. Flight season ranges from May 20 to September 5 in Canada, with no very obvious peak. Anderson (1976) records the peak of emergence in Oregon as August/September.

*Distribution.*— Recorded from New Mexico, California, to southern Yukon (Map 66). In Canada, widely recorded from plains and near-foothills areas of Alberta, with scattered records from British Columbia, and Whitehorse, Yukon.

### *Hydropsyche jewetti* Denning

Map 67; Fig. 430–434

*Hydropsyche jewetti* Denning, 1965:78; Schefter, Wiggins, & Unzicker, 1986:73 (as synonym of *H. cockerelli*).

See note at end of 'Introduction'.

*Description.*— Male fore-wing length 10.14 mm; golden brown, faintly irrorate. Hind-wing very pale gold. Antennae pale brownish yellow; basal nine flagellar annuli each with oblique, dark band. Vertex deep chocolate, slightly paler posteriorly. Spurs pale yellow-brown; lateral member of middle leg pairs markedly shorter than mesal companions. Thorax dark chocolate-brown, to lighter laterally. Legs pale straw.

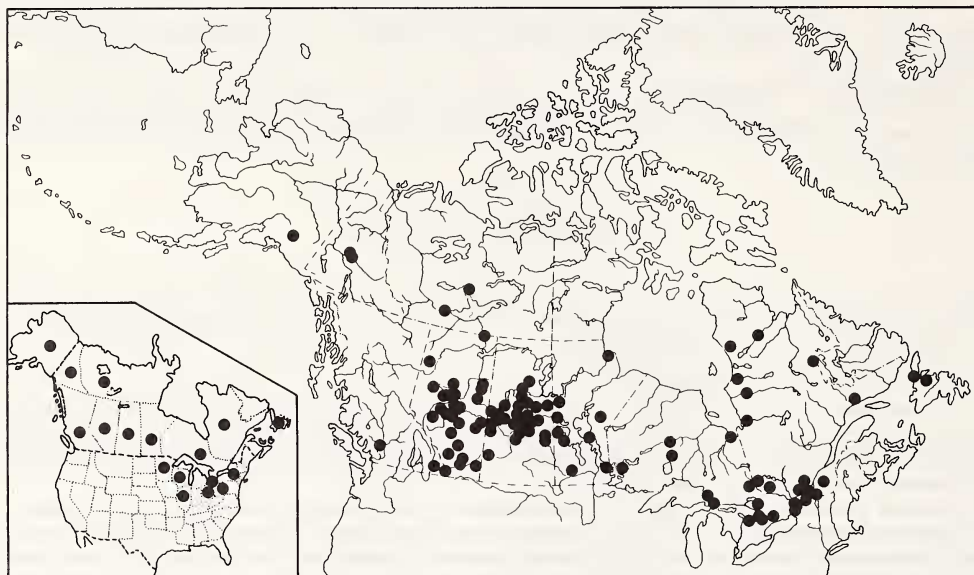
*Genitalia.* Male. (Fig. 430–434). (Specimen from 1-mile Ck, Hwy 5, N of Princeton, British Columbia). Males distinguished by tergum X distal lobes, in lateral aspect (Fig. 430), directed postero-dorsad, slightly cleft distally to two rounded lobes; by distal article of clasper, in lateral aspect, acute-triangular; by tergum X distal lobes, in dorsal aspect (Fig. 431), short, acuminate, with tips turned slightly mesad; and by distal teeth of aedeagus dorsal lobes small, curved

only slightly at base (Fig. 433).

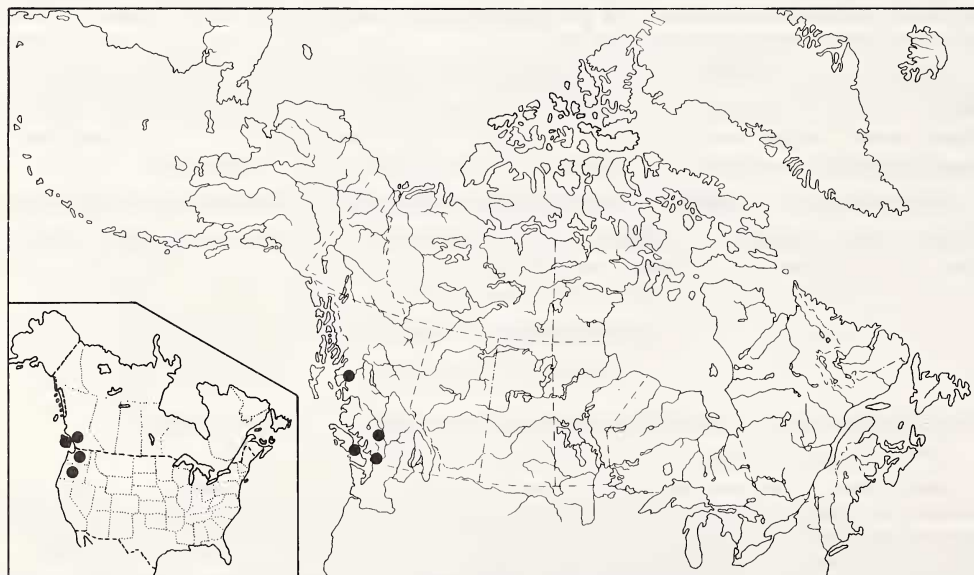
*Genitalia.* Female. Unknown.

*Biology.*— Almost nothing known. 1-mile Creek is a small, rocky stream flanked by Poplar and farmland. Date of collection was July 13. Newell & Potter (1973) give June/July as Montana flight season.

*Distribution.*— Presently known only from western Montana and south-central British Columbia (Map 67).

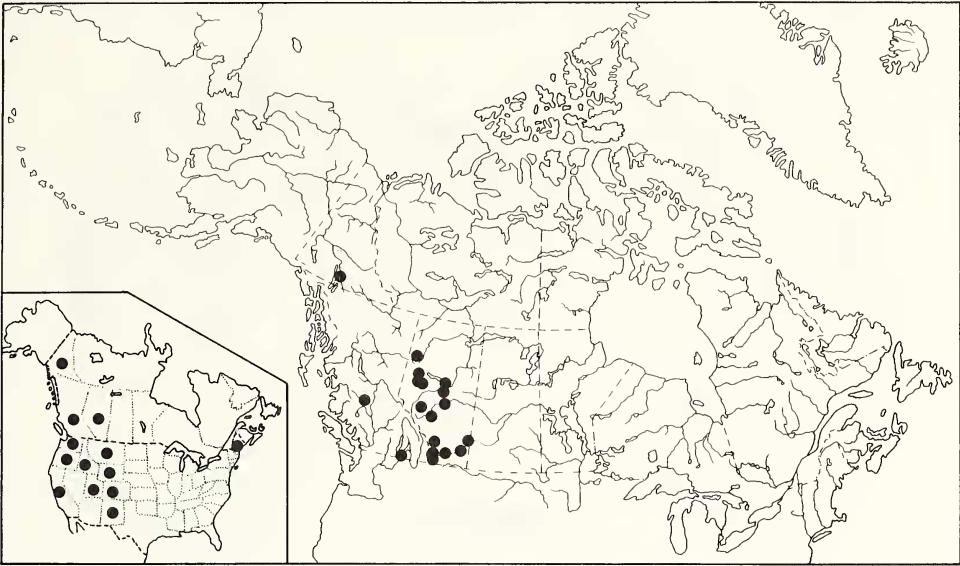


Map 64. Collection localities for *Hydropsyche alternans* (Walker) in Canada and Alaska, with known distribution in North America by state or province.



Map 65. Collection localities for *Hydropsyche centra* in Canada, with known distribution in North America by state or province.





Map 66. Collection localities for *Hydropsyche cockerelli* Banks in Canada, with known distribution in North America by state or province.



Map 67. Collection localities for *Hydropsyche jewetti* Denning in Canada, with known distribution in North America by state or province.

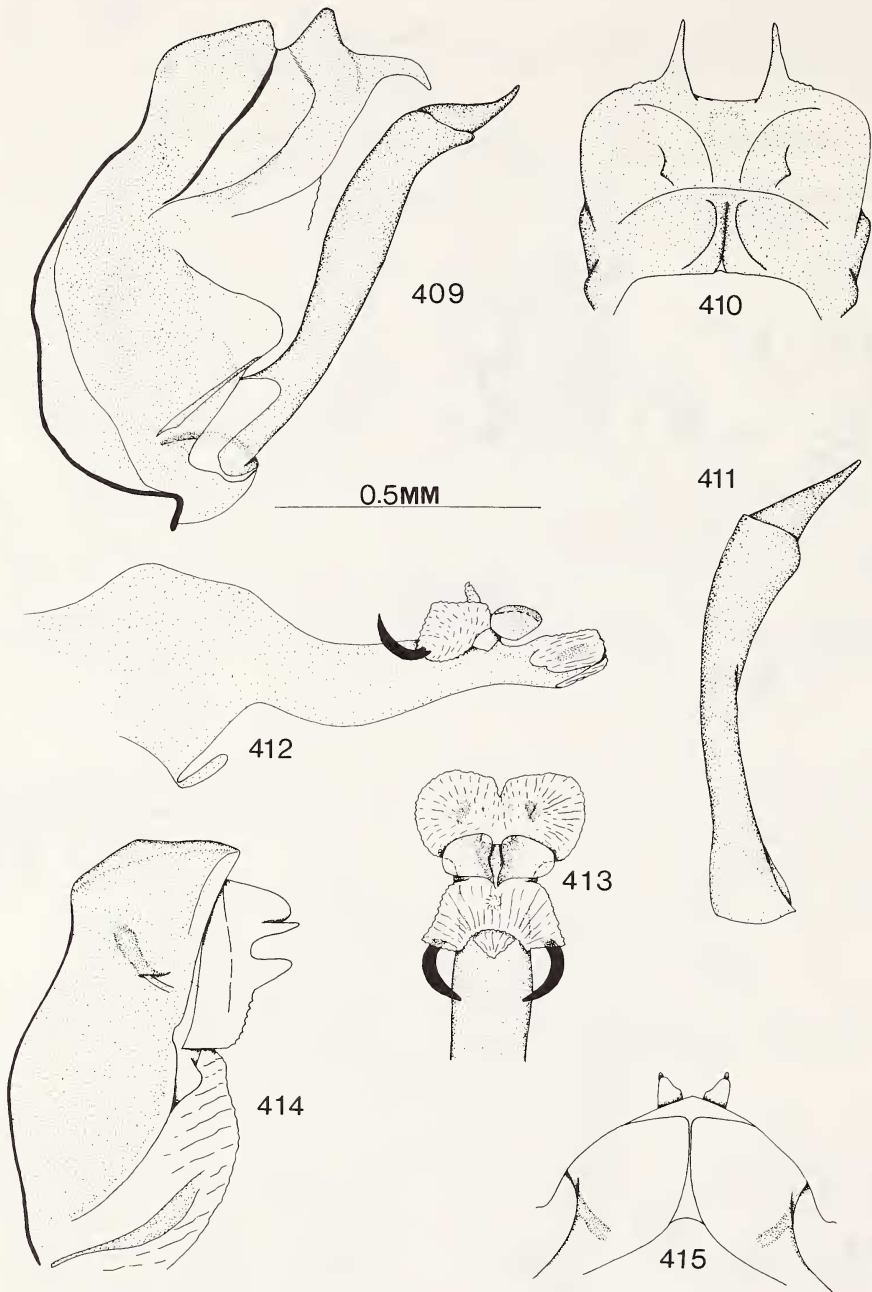


Fig. 409–415, *Hydropsyche alternans* (Walker): 409, genital capsule of male, lateral aspect; 410, genital capsule of male, dorsal aspect; 411, left clasper of male, posterior aspect; 412, aedeagus of male, lateral aspect; 413, aedeagus of male, dorsal aspect of tip; 414, genital segments of female, lateral aspect; 415, genital segments of female, dorsal aspect.

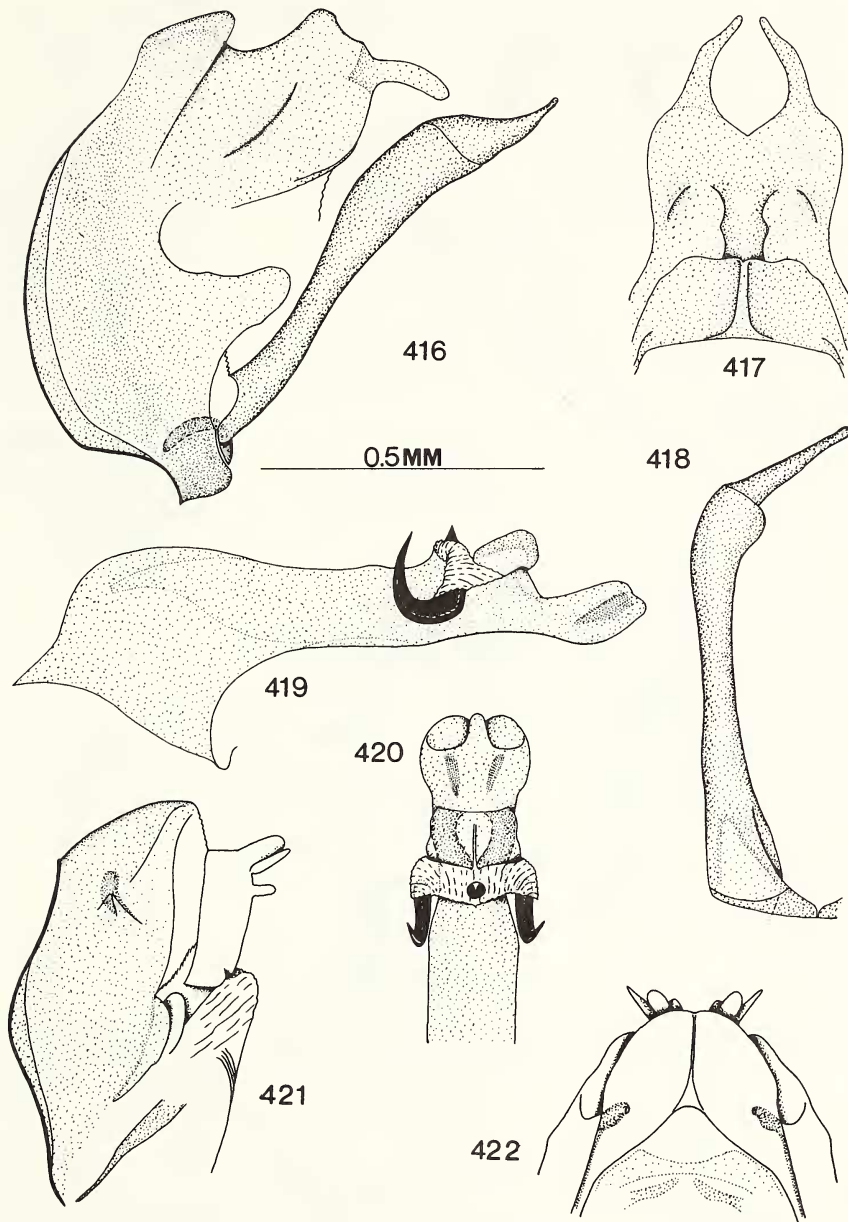


Fig. 416–422, *Hydropsyche centra* Ross: 416, genital capsule of male, lateral aspect; 417, genital capsule of male, dorsal aspect; 418, left clasper of male, posterior aspect; 419, aedeagus of male, lateral aspect; 420, aedeagus of male, dorsal aspect of tip; 421, genital segments of female, lateral aspect; 422, genital segments of female, dorsal aspect.

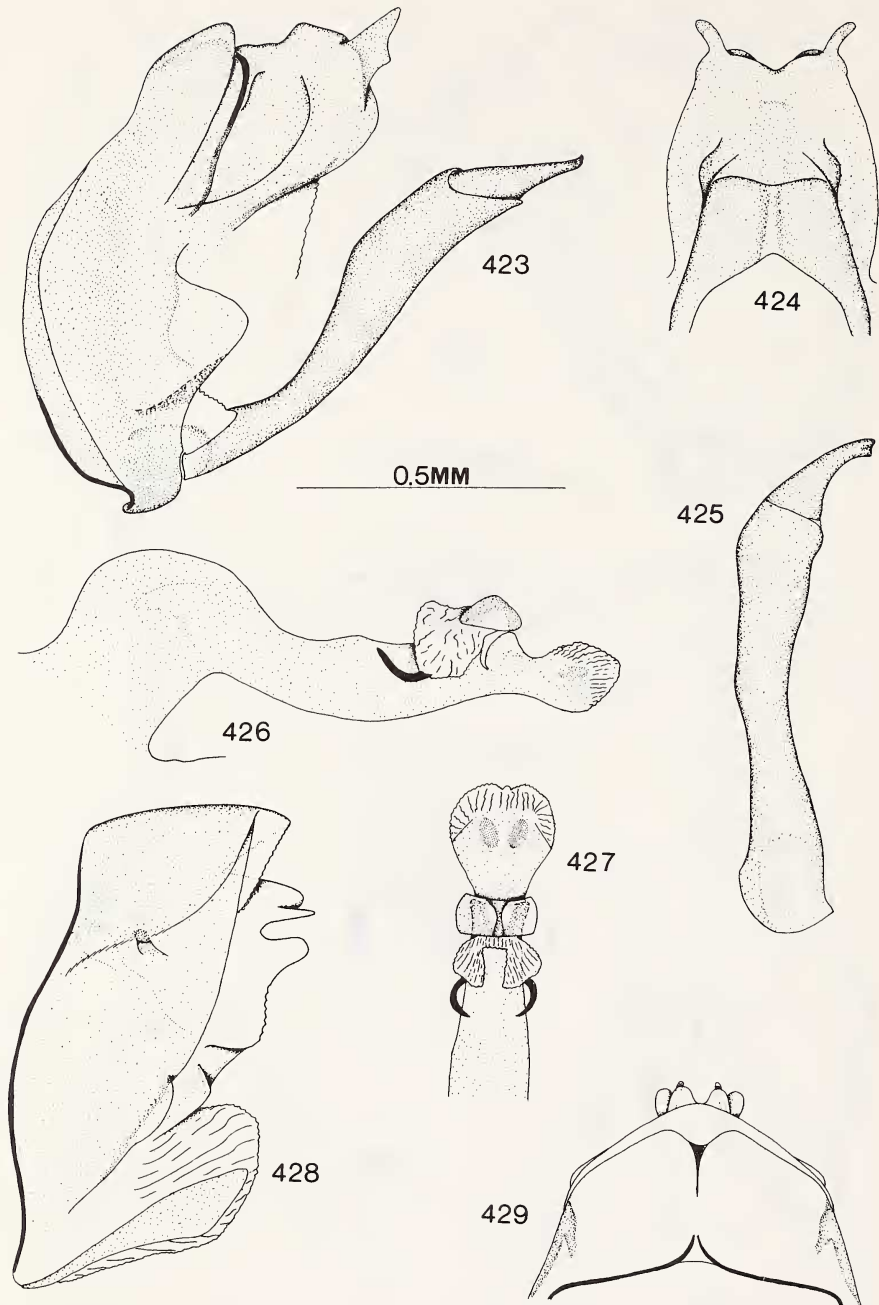


Fig. 423–429, *Hydropsyche cockerelli* Banks: 423, genital capsule of male, lateral aspect; 424, genital capsule of male, dorsal aspect; 425, left clasper of male, posterior aspect; 426, aedeagus of male, lateral aspect; 427, aedeagus of male, dorsal aspect of tip; 428, genital segments of female, lateral aspect; 429, genital segments of female, dorsal aspect.

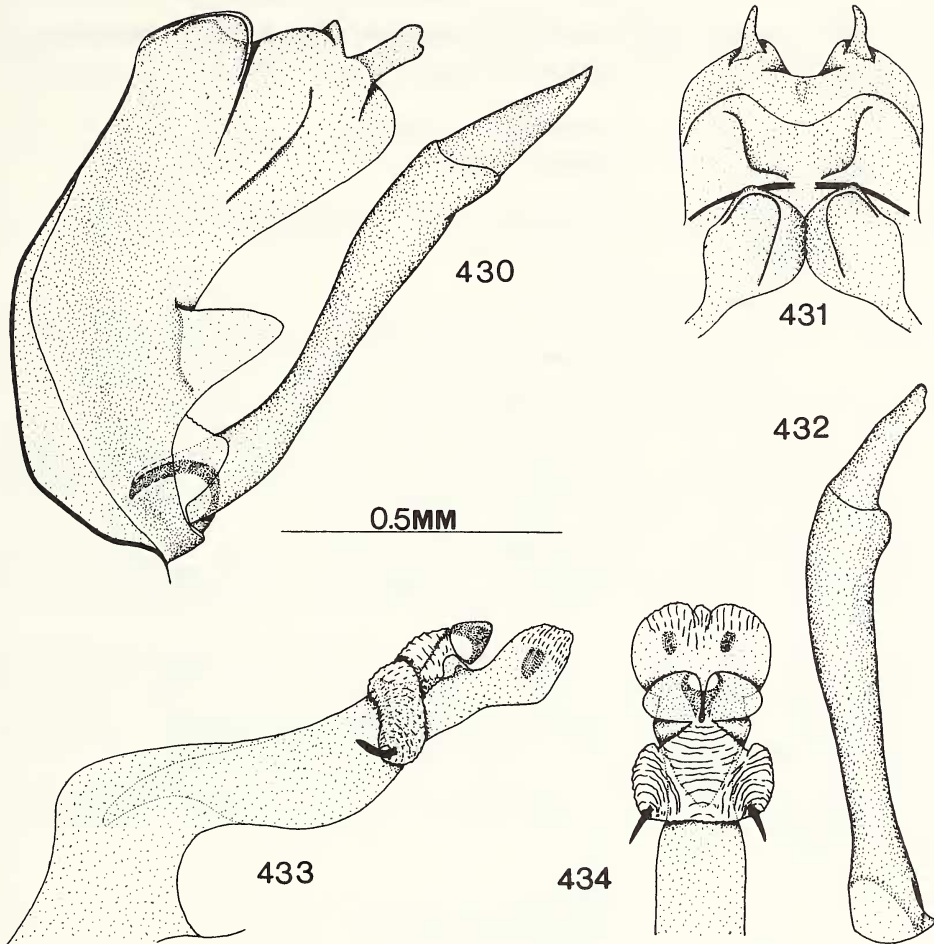


Fig. 430–434, *Hydropsyche jewetti* Denning: 430, genital capsule of male, lateral aspect; 431, genital capsule of male, dorsal aspect; 432, left clasper of male, posterior aspect; 433, aedeagus of male, lateral aspect; 434, aedeagus of male, dorsal aspect of tip.

## SUBGROUP E

This subgroup characterised by aedeagus dorsal lobes with one large tooth (distally & laterally), and cluster of small spines (laterally & distally).

*Hydropsyche riola* Denning

Map 68; Fig. 435–441

*Hydropsyche riola* Denning, 1942:49; Denning, 1943:133; Ross, 1944:294; Schefter, Wiggins, & Unzicker, 1986:69 (as synonym of *H. alhedra*).

*Symphitopsyche riola*; Schuster & Etnier, 1978:44.

See note at end of 'Introduction'.

**Description.**— Male fore-wing length 9.52 mm; bright grey-brown, with alternate areas of colour and hyaline membrane; female more generally irrorate. Antennae brown; basal eight flagellar annuli each with oblique, dark band. Vertex deep brown anteriorly, to deep orange-brown posteriorly. Spurs yellow-brown; lateral member of middle and hind-leg pairs notably shorter than mesal companions. Thorax deep brown. Legs brownish yellow to straw.

**Genitalia.** Male. (Fig. 435–439). (Specimen from creek, Hwy 932, 6 miles S of Whitecourt, Alberta). Males distinguished by tergum X distal lobes, in dorsal aspect (Fig. 436), close together, long, evenly tapered, curved slightly mesad, with long elliptical gap between; by basal article of clasper, in posterior aspect (Fig. 437), with very narrow basal half; and by aedeagus dorsal lobe, in lateral aspect (Fig. 438), with long, slender, acuminate tooth distally, and cluster of spines mid-way to tooth, on posterior face of lobe.

**Genitalia.** Female. (Fig. 440–441). (Specimen from creek, Hwy 932, 6 miles S of Whitecourt, Alberta). Females distinguished by clasper receptacle, in dorsal aspect (Fig. 441), directed mesad; by receptacle, in lateral aspect (Fig. 440), traversed by thin, dark line from dorsum of segment X; and by sclerotised strap of vulval scale long, sinuate, widened distally.

**Biology.**— My records indicate that larvae are not especially restricted in stream types occupied. Adult collecting sites include sluggish, silty prairie streams; turbulent, boulder-bottomed small rivers; smooth-flowing, earth-banked boreal creeks; and weed-filled streamlets. Flight season records range from May 25 to August 8, in Canada.

**Distribution.**— Recorded in narrow zone across North America from Massachusetts to Alaska (Map 68). Other than in Saskatchewan and Alberta, the known distribution is disjointed.

*Hydropsyche sparna* Ross

Map 69; Fig. 442–448

*Hydropsyche sparna* Ross, 1938b:150; Denning, 1943:134; Ross, 1944:97; Schefter & Wiggins, 1986:74.

*Symphitopsyche sparna*; Schuster & Etnier, 1978:52.

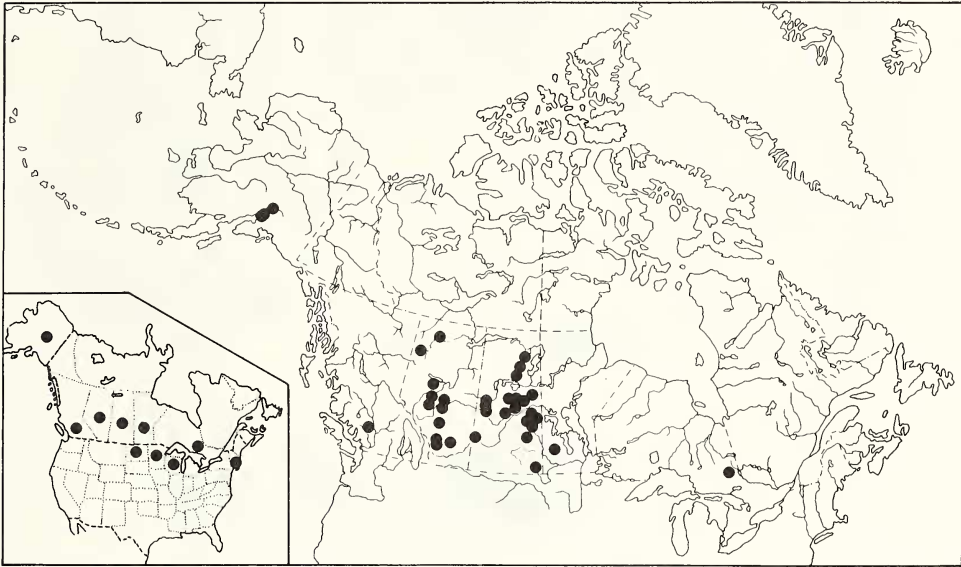
**Description.**— Male fore-wing length 8.27 mm; pale golden brown, no patten evident. Hind-wing faintly tinted golden brown. Antennae yellow; no dark banding on flagellar annuli. Vertex brownish yellow; orange-brown in female. Spurs yellow; lateral member of middle leg pairs markedly shorter than mesal companions. Thorax brownish yellow; orange-brown in female. Legs yellow to straw.

**Genitalia.** Male. (Fig. 442–446). (Specimen from Flanders, Morris Co., New Jersey, USA). Males distinguished by distal article of clasper, in lateral aspect (Fig. 442), abruptly narrowed, from wide base, to long, thin, slightly curved process; by tergum X distal lobes, in dorsal aspect (Fig. 443), directed posterad, slightly twisted, with wide, u-shaped gap between; and by aedeagus dorsal lobe, in lateral aspect (Fig. 445), with distal cluster of spines, and tooth (wide-based, abruptly narrowed to distal spine) located at mid-point on posterior face.

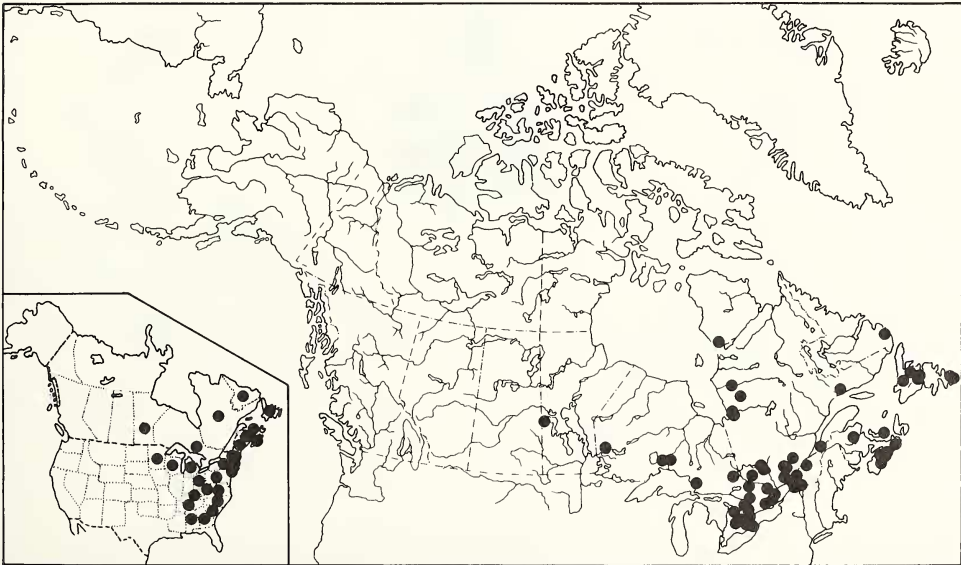
**Genitalia.** Female. (Fig. 447–448). (Specimen from Flanders, Morris Co., New Jersey, USA). Females distinguished by clasper receptacle, in lateral aspect (Fig. 447), with thin, dark line from dorsum of segment X terminated at dorsal extremity of receptacle; by receptacle, in dorsal aspect (Fig. 448), directed postero-mesad; and by vulval scale sclerotised strap thin, angled.

**Biology.**— Larvae exhibit wide ecological tolerance, from sluggish, small, organically rich streams, to fast, clear, cold trout-stream waters (Schuster & Etnier, 1978). Canadian flight season ranges from May 17 to September 26, with bulk of records from August.

*Distribution.*— Predominantly an eastern species, recorded from Georgia to Newfoundland, west across the Appalachians, with extension from Michigan to Manitoba (Map 69). In Canada, known from Duck Mountain Provincial Park, on western boundary of Manitoba, to Labrador and Newfoundland. From the above it may be surmised that the species is confined to woodland waters.



Map 68. Collection localities for *Hydropsyche riola* Denning in Canada and Alaska, with known distribution in North America by state or province.



Map 69. Collection localities for *Hydropsyche sparna* Ross in Canada, with known distribution in North America by state or province.

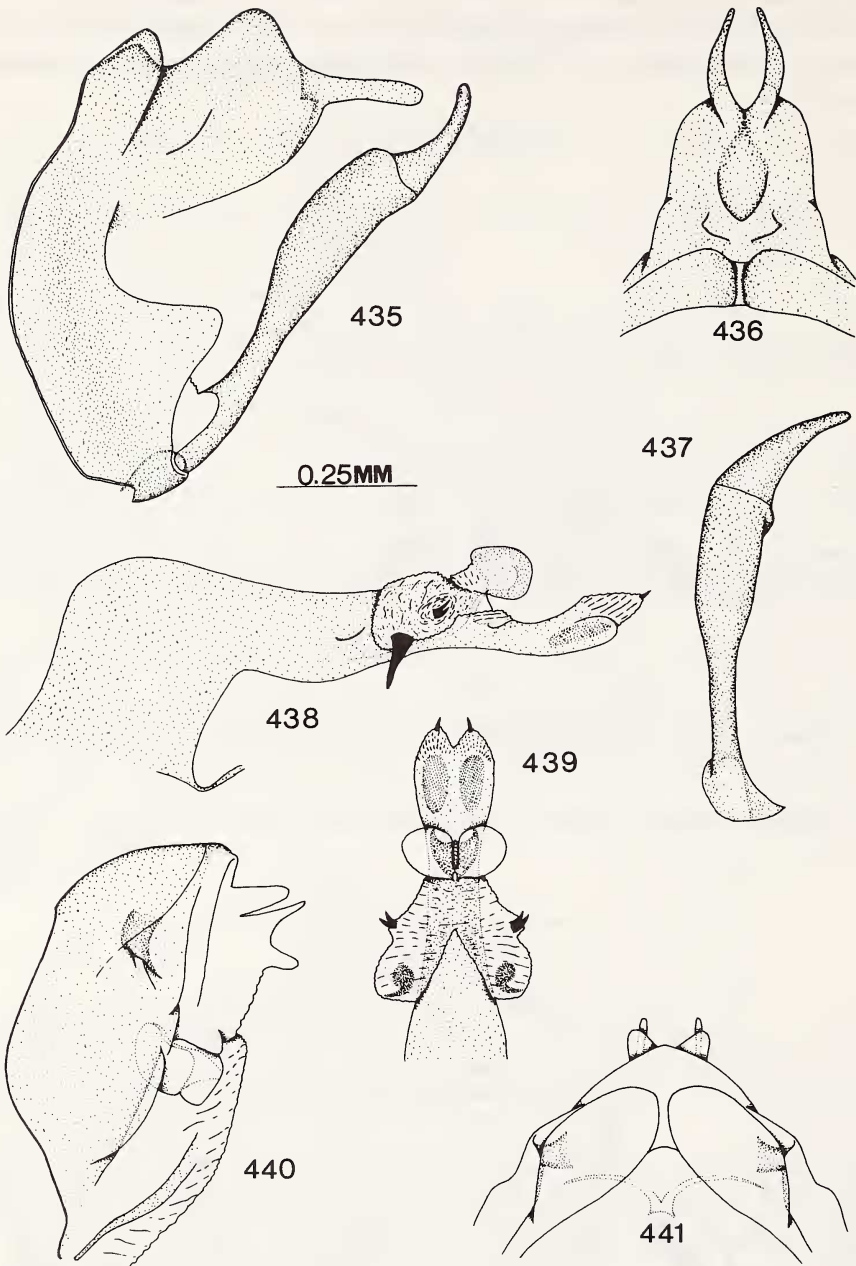


Fig. 435–441, *Hydropsyche riola* Denning: 435, genital capsule of male, lateral aspect; 436, genital capsule of male, dorsal aspect; 437, left clasper of male, posterior aspect; 438, aedeagus of male, lateral aspect; 439, aedeagus of male, dorsal aspect of tip; 440, genital segments of female, lateral aspect; 441, genital segments of female, dorsal aspect.



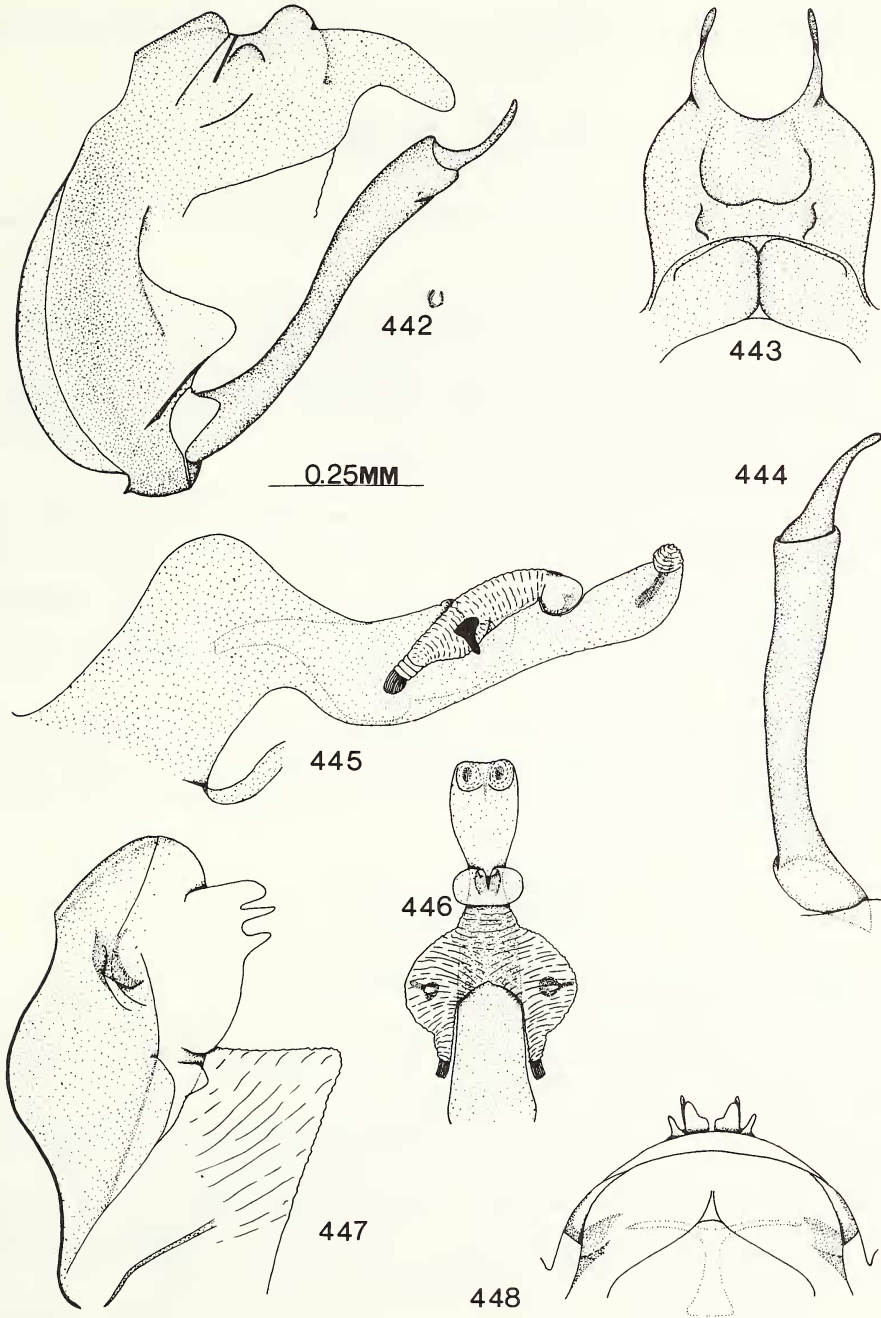


Fig. 442-448, *Hydropsyche sparna* Ross: 442, genital capsule of male, lateral aspect; 443, genital capsule of male, dorsal aspect; 444, left clasper of male, posterior aspect; 445, aedeagus of male, lateral aspect; 446, aedeagus of male, dorsal aspect of tip; 447, genital segments of female, lateral aspect; 448, genital segments of female, dorsal aspect.

## SUBGROUP F

This group characterised by aedeagus dorsal membranous lobes without teeth or spines in any form.

*Hydropsyche oslari* Banks

Map 70; Fig. 449–455

*Hydropsyche oslari* Banks, 1905a:13; Betten, 1934:194; Milne, 1936:70, 71, 73; Ross, 1944:294; Schefter & Wiggins, 1986:66.

*Hydropsyche partita* Banks, 1914:252; Milne, 1936:73.

**Description.**— Male fore-wing length 9.91 mm; pale grey-brown, uniformly irrorate, with scattered larger areas of uniform colour. Antennae brownish cream; basal seven flagellar annuli each with oblique, dark band. Vertex dark brown anteriorly, to yellow-brown posteriorly. Spurs yellow to cream; lateral member of middle leg pairs notably shorter than mesal companions; not so noticeable in female. Thorax rich red-brown, to yellow-brown laterally. Legs yellowish cream.

**Genitalia.** Male. (Fig. 449–453). (Specimen from Oldman R., Hwy 922, Alberta). Males distinguished by distal article of clasper, in lateral aspect (Fig. 449), evenly, gradually narrowed from base to long, dorsally curved distal portion; by distal article, in posterior aspect (Fig. 451), with very long, slender, linear tip; and by dorsal lobes of aedeagus with dorsally directed median lobe between two minute lateral lobes (Fig. 452, 453).

**Genitalia.** Female. (Fig. 454–455). (Specimen from Oldman R., Hwy 922, Alberta). Females distinguished by clasper receptacle, in lateral aspect (Fig. 454), located high on lateral wall of segment X, directed dorso-anterad, without evident inner opening; by receptacle, in dorsal aspect (Fig. 455), directed mesad; and by vulval scale sclerotised strap long, gradually widened distally, angled at mid-point (Fig. 454).

**Biology.**— I have records of adults from shallow, small, rock and gravel streams of negligible turbulence, to larger rivers of swift, deep, turbulent waters (clear or turbid). Canadian flight season ranges from June 4 to September 14, with diffuse peak through July/August.

**Distribution.**— Western species, ranging from Mexico to western Yukon (Map 70). In Canada, widely recorded from open plains, foothills, and Boreal Forest of Alberta, from throughout British Columbia, from Vancouver Island, with one record from Dawson City, Yukon.

*Hydropsyche ventura* Ross

Map 71; Fig. 456–462

*Hydropsyche ventura* Ross, 1941:92; Ross, 1944:294; Schefter & Wiggins, 1986:80.

*Symphitopsyche ventura*; Schuster & Etnier, 1978:55.

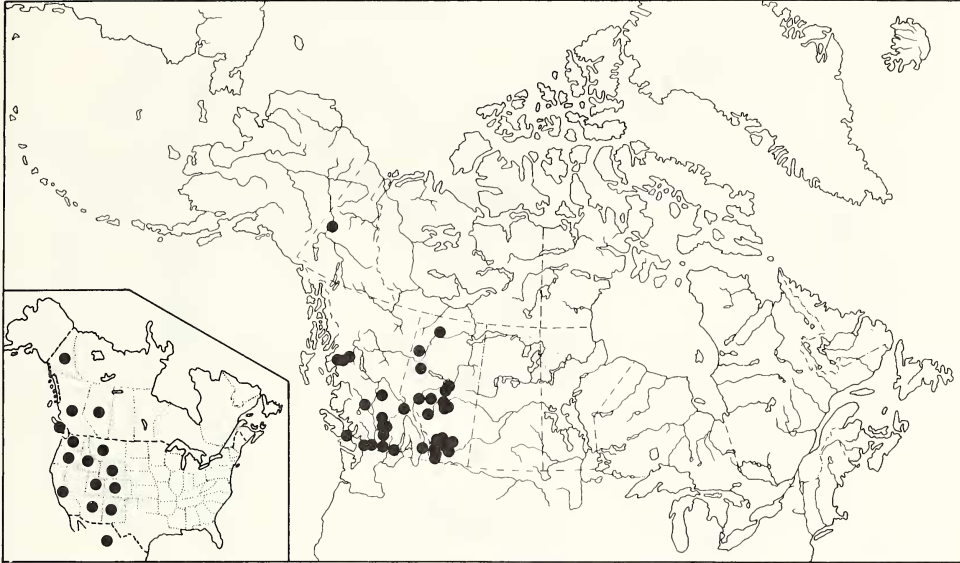
**Description.**— Male fore-wing length 8.38 mm; uniformly very pale reddish brown; anal edge with alternate dark and pale areas. Hind-wing very palely tinted. Antennae uniform pale straw. Vertex deep red-brown, warts paler. Spurs straw-coloured. Thorax deep red-brown overall. Legs straw-coloured.

**Genitalia.** Male. (Fig. 456–459). (Specimen from St Hippolyte, Québec). Males distinguished by distal article of clasper, in lateral aspect (Fig. 456), of almost uniform width, with triangular tip; by tergum X distal lobes, in dorsal aspect (Fig. 457), long, slender, well spaced, curved somewhat mesad about roughly circular gap between; and by aedeagus dorsal lobes, in dorsal aspect (Fig. 460), each bilobed, with posterior short, stout lobe, and anterior long, thin lobe.

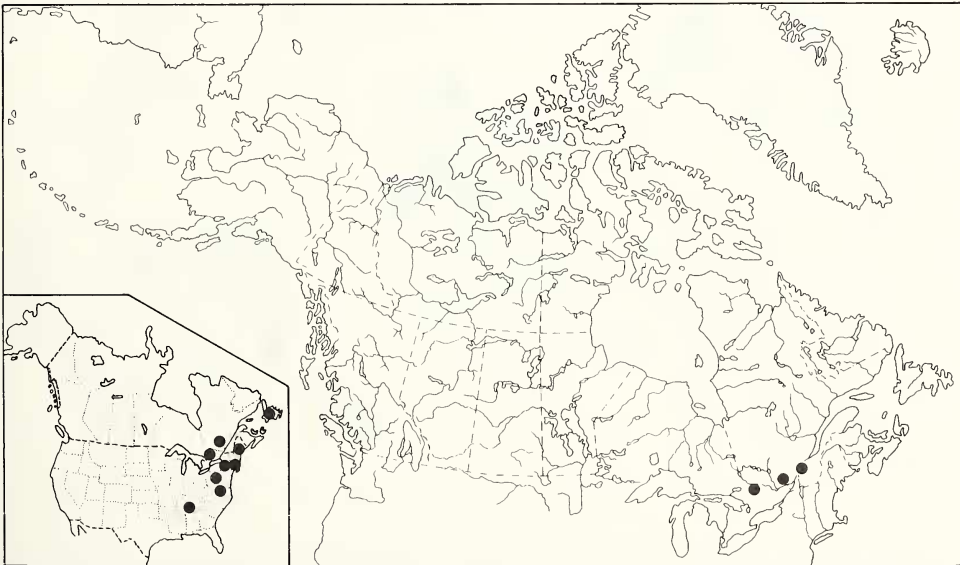
**Genitalia.** Female. (Fig. 461–462). (Specimen from St Hippolyte, Québec). Females distinguished by clasper receptacle, in lateral aspect (Fig. 461), oriented vertically, directed anterad, crescentic, with inner opening not visible; by receptacle, in dorsal aspect (Fig. 462), directed mesad, with inner opening on small secondary tubercle; and by vulval scale sclerotised strap with long, slender, slightly widened proximal portion, semi-circular distal portion.

**Biology.**— Little known. Schuster & Etnier (1978) describe one particular site in detail, but make no generalisations. They give known flight season as early April to September.

**Distribution.**— Recorded from Tennessee to Newfoundland, with scattered records from southern Québec, eastern Ontario (Map 71).



Map 70. Collection localities for *Hydropsyche oslari* Ross in Canada, with known distribution in North America by state or province.



Map 71. Collection localities for *Hydropsyche ventura* Ross in Canada, with known distribution in North America by state or province.

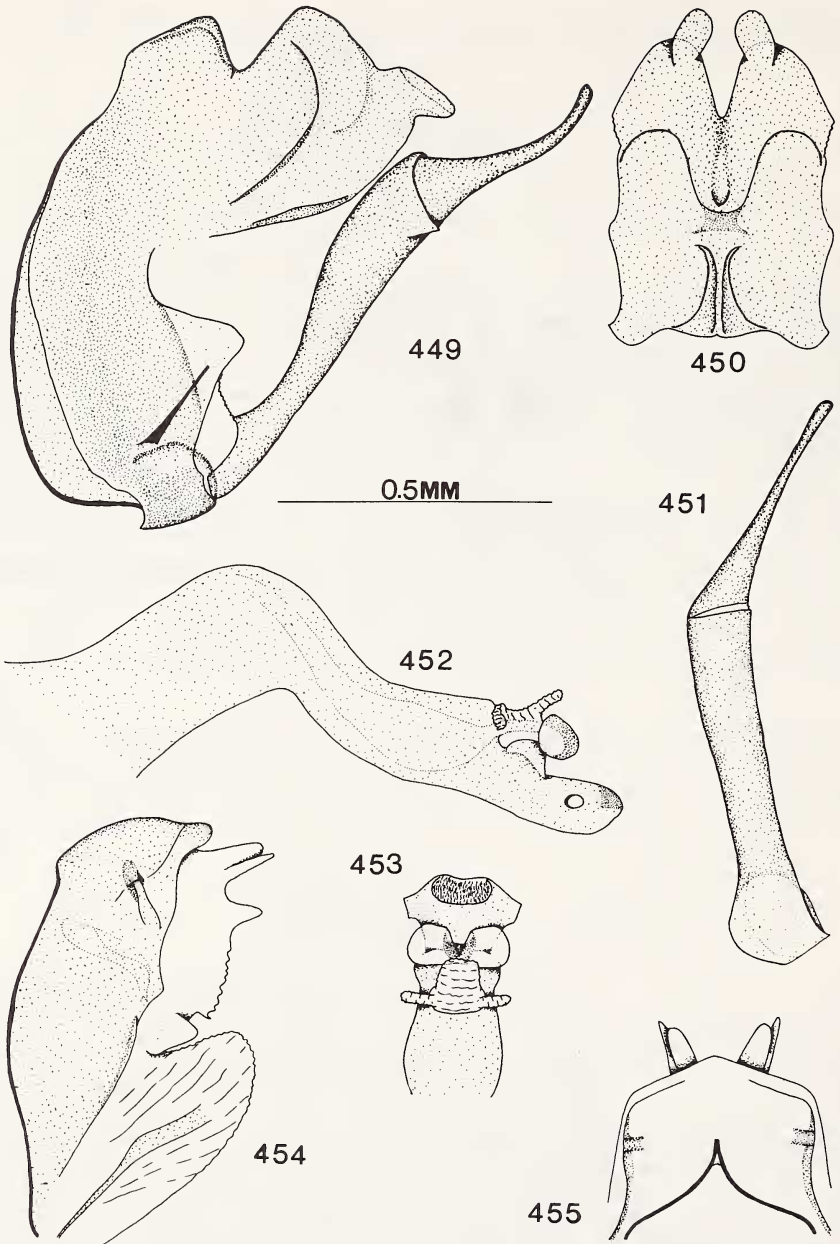


Fig. 449-455, *Hydropsyche oslari* Ross: 449, genital capsule of male, lateral aspect; 450, genital capsule of male, dorsal aspect; 451, left clasper of male, posterior aspect; 452, aedeagus of male, lateral aspect; 453, aedeagus of male, dorsal aspect of tip; 454, genital segments of female, lateral aspect; 455, genital segments of female, dorsal aspect.

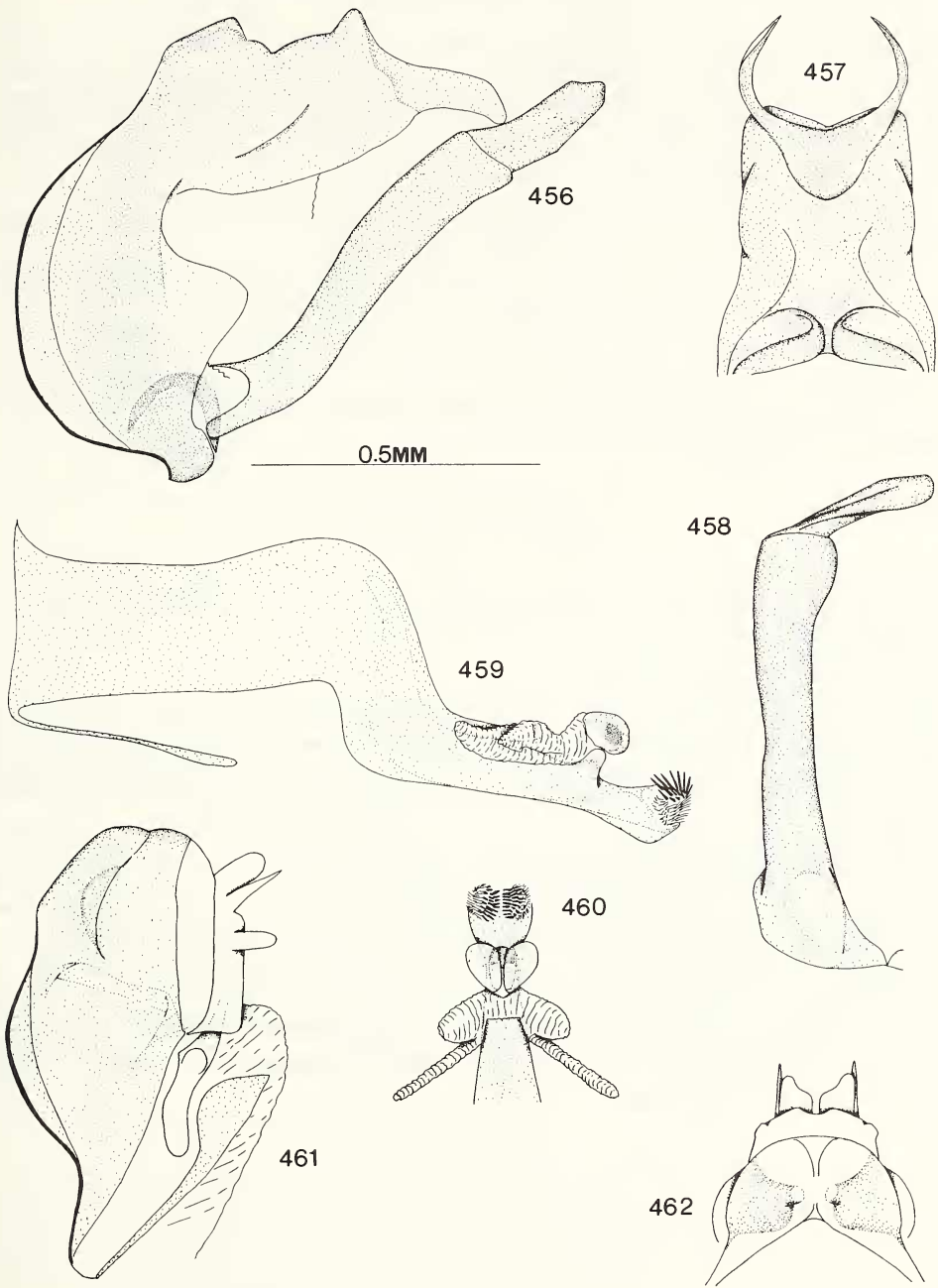


Fig. 456-462, *Hydropsyche ventura* Ross: 456, genital capsule of male, lateral aspect; 457, genital capsule of male, dorsal aspect; 458, left clasper of male, posterior aspect; 459, aedeagus of male, lateral aspect; 460, aedeagus of male, dorsal aspect of tip; 461, genital segments of female, lateral aspect; 462, genital segments of female, dorsal aspect.

Genus *Potamyia* Banks  
Map 72; Fig. 6, 463–468

*Potamyia* Banks, 1900:259; Betten, 1934:197; Ross, 1944:85; Wiggins, 1977:116; Schmid, 1980:59.

**Description.**— Head globular, convex; malar space large. Antennae very fine, long, especially in male; basal article globular. Fore-wings (Fig. 6a) with few hairs. Hind-wings (Fig. 6b) large, especially in male; somewhat pointed distally. Hind-wing fl present; stems of veins M and Cu1 very close, parallel; cross-veins M3+Cu1 and Cu1-Cu2 very close together. Fore-wing without cross-veins Sc-R1 and R1-R2+R3. Spur formula 0,4,4 male; 1,4,4 female. Fore-leg tarsi of male strongly spinate; claws asymmetrical, overhung by stout, black setae.

**Genitalia.** Male. (Fig. 463–466). Very similar to genitalia of *Hydropsyche* and *Cheumatopsyche*.

**Genitalia.** Female. (Fig. 467–468). Again, very similar to genitalia of *Hydropsyche* and *Cheumatopsyche*. Sternite VIII longitudinally divided throughout. Clasper receptacle not present (Fig. 467).

The above characters are a melange of characters shared with the Macronematinae, *Hydropsyche*, and *Cheumatopsyche*, plus several peculiar to *Potamyia*.

**Biology.**— Larvae prefer large, warmish rivers, and appear to congregate on rocks in sandy, silt-free conditions in slower currents.

*Potamyia* is confined to Siberia and eastern North America east of Montana. Of two known species one, *P. flava*, is recorded from North America.

*Potamyia flava* (Hagen)  
Map 72; Fig. 6, 463–468

*Macronema flavum* Hagen, 1861:285.

*Potamyia flava*; Banks, 1900:259; Betten, 1934:198; Denning, 1943:136; Ross, 1944:85; Wiggins, 1977:Fig. 6.11; Schmid, 1980:Fig. 141-143.

*Hydropsyche flava*; Milne, 1936:73.

*Hydropsyche kansasensis* Banks, 1905a:15; Milne, 1936:73.

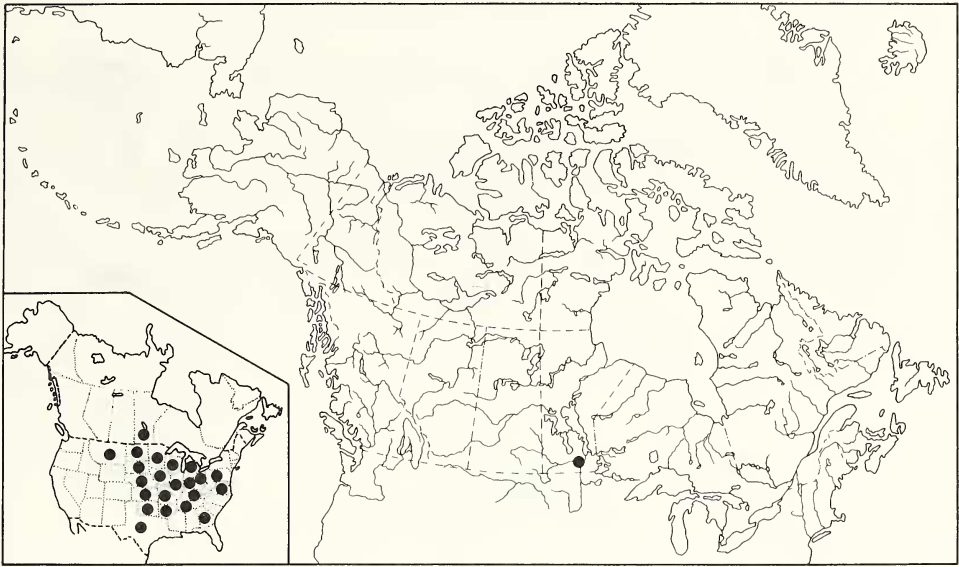
**Description.**— Male fore-wing length 9.20 mm; uniform light brownish yellow; no pattern. Antennae light yellow-brown; basal two flagellar annuli each with oblique, paler band; less evident in female. Vertex light yellow-brown; uniform brownish yellow in female. Spurs pale, dull yellow; in female, lateral member of middle leg pairs, and hind-leg apical pair, notably shorter than mesal companions. Thorax pale, dull yellow-brown throughout. Legs dull straw; reddish yellow in female.

**Genitalia.** Male. (Fig. 463–466). (Specimen from Hamilton, Illinois, USA). Males distinguished by high, narrow segment IX in lateral aspect (Fig. 463); by small, acuminate, dorso-laterally directed distal lobes of tergum X (Fig. 463-466); and by distal article of clasper, in lateral aspect, widened distally.

**Genitalia.** Female. (Fig. 467–468). (Specimen from Washington Co., Arkansas, USA). Females distinguished by lack of any sign of clasper receptacle on lateral wall of segment X (Fig. 467); and by lack of vulval scale sclerotised strap.

**Biology.**— See under genus above. The only Canadian flight date is June 6, in Manitoba.

**Distribution.**— Widespread throughout eastern United States (Map 72), as far west as Montana; not known from New England States. In Canada Schmid (1980) reports this species from southern Ontario. I have examined material taken on the banks of the Assiniboin River, Manitoba (just W of Winnipeg).



Map 72. Collection localities for *Potamyia flava* (Hagen) in Canada, with known distribution in North America by state or province.

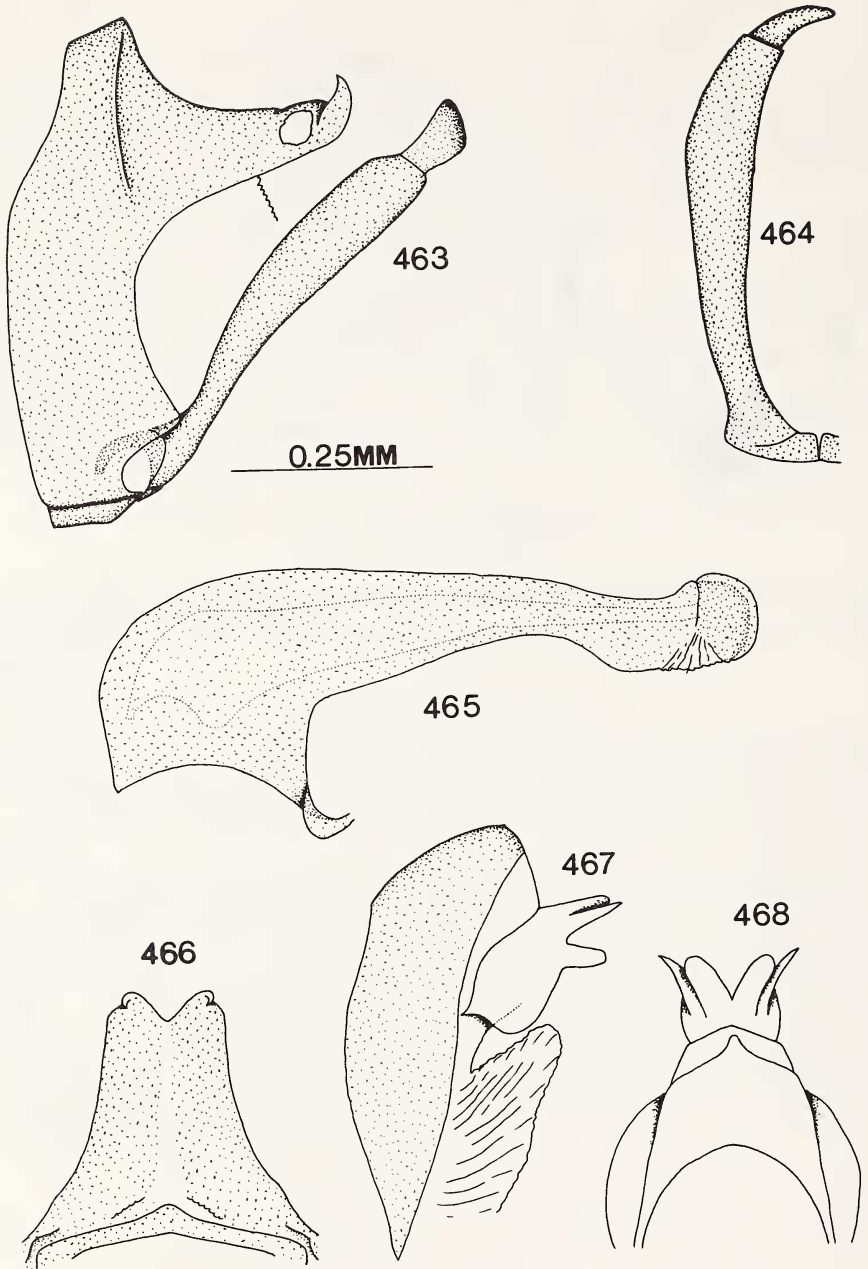


Fig. 463-468, *Potamyia flava* (Hagen): 463, genital capsule of male, lateral aspect; 464, left clasper of male, posterior aspect; 465, aedeagus of male, lateral aspect; 466, genital capsule of male, dorsal aspect; 467, genital segments of female, lateral aspect; 468, genital segments of female, dorsal aspect.



## SUBFAMILY DIPLECTRONINAE ULMER

Diplectroninae Ulmer, 1951:303; Ross, 1956:10; Marlier, 1962:135; Wiggins, 1977:93; Schmid, 1980:61.

Following characterisation of adults derived from Marlier (1962).

*Description.*— Medium to large (wing-span 12–20 mm). Wings generally large; wide basally, rounded or angular distally. Antennae equal in length to fore-wings, or slightly longer. Cephalic warts less prominent than in Macronematinae; posterior pair large, oval; anterior pair quite small; interantennal wart round. Thorax large, robust. Male fore-leg tarsal claws normal, equal, not overhung by setal tufts. Middle leg tarsi of female not expanded, not flattened. Spur formula 2,4,4. Fore-wing Sc and R1 (Fig. 4a) complete, unfused, or joined distally; often robust. Discoidal and median cells small, subequal, closed. Forks fI–fV present; fI, fIII, and fV petiolate. Thyridial cell closed, in contact with median. Hind-wing (Fig. 4b) often widened at mid-point; Sc and R1 distinct throughout; discoidal cell closed, elongate; fII, fIII, and fV present; median cell open.

*Genitalia.* Male. (Fig. 469–472, 475–479). Much as usual for Hydropsychidae; simple, very little modified. Tergum X roof-like dorsad of aedeagus; not separable from segment IX; with or without wart-like preanal appendages. Aedeagus simple (Fig. 478) or complex (Fig. 471), curved, basally expanded, without spines. Claspers (inferior appendages) long, of two articles; distal article smaller than basal article.

*Genitalia.* Female. (Fig. 473–474, 480–481). Much as for Hydropsychinae. With or without clasper receptacles; if present, not prominent. Cerci prominent.

Genus *Aphropsyche* Ross

Map 73; Fig. 469–474

*Aphropsyche* Ross, 1941:78; Ross, 1944:83.

Following generic characterisation derived from Ross (1941).

*Description.*— Head somewhat prognathoid; eyes widely separated, located anterad. Antennae short, somewhat robust; pedicel only half as long as scape, of thickness similar to flagellum. Vertex convex; mesal ridges inconspicuous; postero-lateral warts large. Pronotum with pair of large, close warts. Wings similar in shape, evenly rounded distally; venation generalised, typical for group; radial veins of hind-wing straight.

*Genitalia.* Male. (Fig. 469–472). Genital capsule basically as for Hydropsychinae, but considerably less regular in outline (Fig. 469); with postero-ventral edge produced posterad. Clasper articles not obviously distinguishable. Aedeagus complex (Fig. 471), with paired (Fig. 472), long, slender, acuminate dorsal lobes; with expanded, rounded, single ventral lobe surmounted by smaller, complex intromittent structure.

*Genitalia.* Female. (Fig. 473–474). Much as for Hydropsychinae. Cercus large, prominent. No clasper receptacle evident. Sternite VIII cleft mesally, more or less throughout length.

*Biology.*— As larvae not yet definitely associated (see Wiggins, 1977), nothing can usefully be included here.

Four species presently known: two in Asia, two in eastern North America. One is likely to be recorded in eastern Canada.

*Aphropsyche doringa* Milne

Map 73; Fig. 469–474

*Aphropsyche doringa* Milne, 1936:68–69, 73; Ross, 1944:294.

*Aphropsyche aprilis* Ross, 1941:78; Ross, 1944:83; Flint, 1966:374 (as synonym of *A. doringa*).

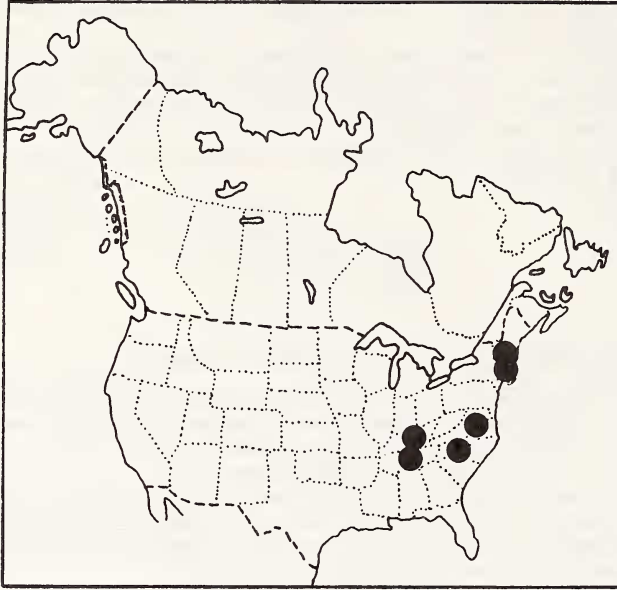
*Description.*— Male fore-wing length 8.81 mm; uniform purple-grey, with stigma and anal edge darker. Hind-wing uniform purple-grey. Female overall darker, more uniform in fore-wing. Antennae uniform dull brown in male; dark purple-brown in female. Vertex deep chocolate to black, warts red-brown, intense black in female with reddish black warts. Spurs purple-brown. Thorax, dorsally, as vertex in either sex; laterally, deep red-brown (to yellow-brown coxae) – deep red-brown throughout in female. Legs yellow-brown proximally, purple-brown distally; dull red-brown throughout in female.

*Genitalia.* Male. (Fig. 469–472). (Specimen from Reid Ck, Blount Co., Tennessee, USA). Males distinguished on basis of aedeagus alone (Fig. 471–472), with paired dorsal lobes, single ventral lobe. Other features are: clasper apparently of one article, curved gently dorsad, of uniform width except for tapered distal end; anterior edge of segment IX highly irregular in lateral aspect (Fig. 469); postero-ventral edge of segment IX with posteriorly projected shelf; and tergum X distal lobes high, black, flared postero-laterad, with slender, acuminate dorsal spine each.

*Genitalia.* Female. (Fig. 473–474). (Specimen from Reid Ck, Blount Co., Tennessee, USA). Females distinguished by vulval scale sclerotised, except membranous distally (Fig. 474); by anterior edge of segment X linear (Fig. 473); and by cercus large, intermediate between dorsal and ventral lobes of segment XI, with minute distal article.

*Biology.*— Almost unknown. Etnier & Schuster (1979) report adult occurrence in Tennessee as April 21 to May 13. Neves (1979) reports adults in Massachusetts in June.

*Distribution.*— Not yet known from Canada, with only scattered records from eastern United States (Map 73), from as far north as New Hampshire.



Map 73. Known distribution of *Aphropsyche doringa* Milne in North America, by state.

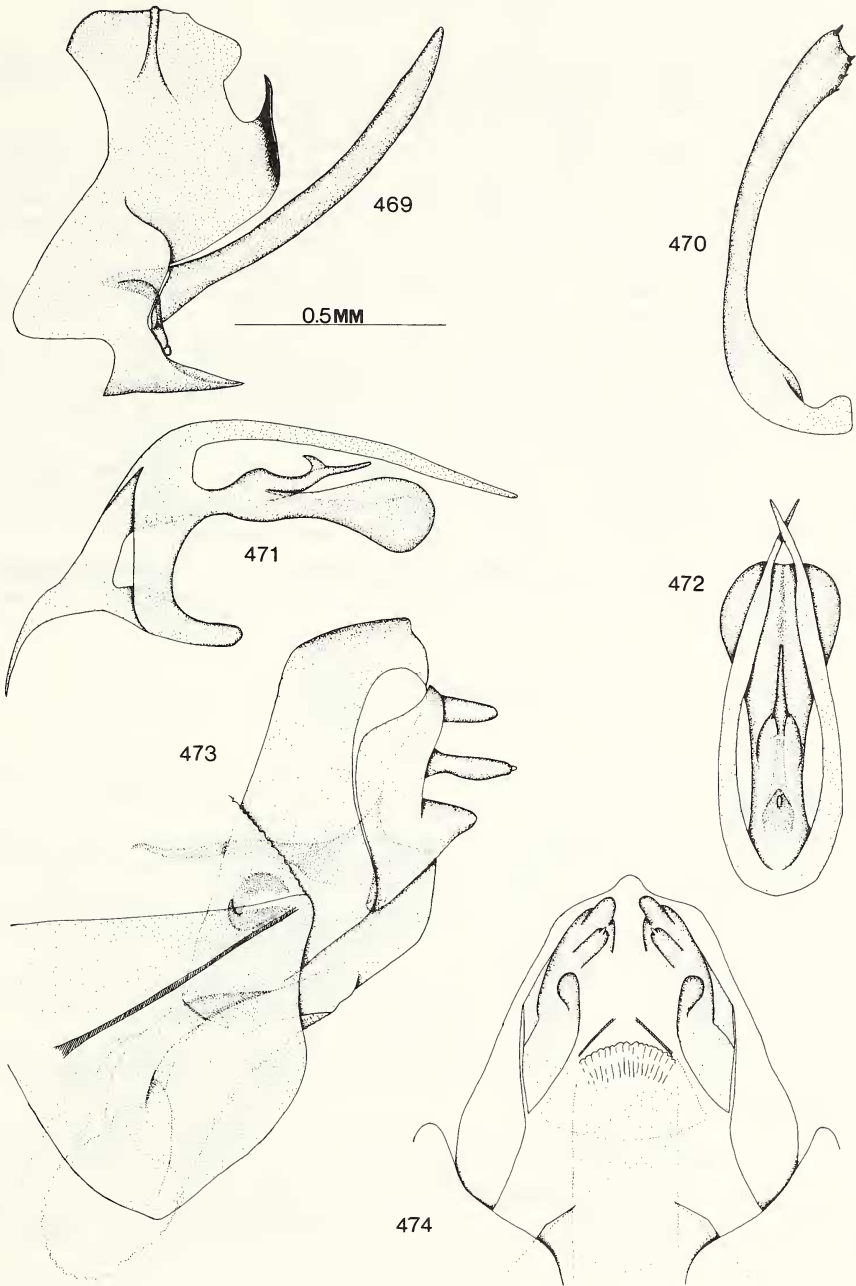


Fig. 469–474, *Aphropsyche doringa* Milne: 469, genital capsule of male, lateral aspect; 470, left clasper of male, posterior aspect; 471, aedeagus of male, lateral aspect; 472, aedeagus of male, dorsal aspect; 473, genital segments of female, lateral aspect; 474, genital segments of female, ventral aspect.

Genus *Diplectrona* Westwood

Map 74; Fig. 475–481

*Diplectrona* Westwood, 1840:49; McLachlan, 1978:374; Betten, 1934:182; Milne, 1936:68; Ross, 1944:84; Bull. Zool. Nomen, 1965:288 (validation: opinion 758); Wiggins, 1977:102; Schmid, 1980:61.

*Aphelocheira* Stephens, 1836:167, 179; Bull. Zool. Nomen., 1965:288 (suppression: opinion 758).

**Description.**— Antennae as long as fore-wings, fine, notched; annuli as thick as long, swollen at mid-point; basal annuli each with oblique, dark band. Maxillary palpi with second article much longer than basal article, third and fourth articles shorter. Vertex with four large warts. Middle leg tarsi of female normal, not flattened, not enlarged. Sternite V with bulge prolonged by very long, thin tube, slightly longer in male than female. Fore-wing (Fig. 4a) widened at chord. Hind-wing (Fig. 4b) large, rounded, distally blunt. Fore-wing I and III petiolate; discoidal cell small, median and thyridial cells large; Cu2 and A markedly curved, postcostal cell much enlarged; cross-veins M3+4-Cu1 and Cu1-Cu2 close. Hind-wing with Sc very thick, R1 very thin, both sinuate, subcostal cell very narrow basally, very large distally; discoidal cell narrow; I and III petiolate.

**Genitalia.** Male. (Fig. 475–479). Segment IX without postero-lateral edge poorly developed (Fig. 475). Segment X not clearly delimited from IX, with two pairs of lobes (one mesal, the other lateral) (Fig. 476). Claspers (inferior appendages) with very long basal article. Aedeagus (Fig. 478) stout, two endothecal lobes distally (Fig. 479).

**Genitalia.** Female. (Fig. 480–481). Sternite VIII completely divided. Segment X with barely visible clasper receptacle (Fig. 480), produced ventrad to form distinct sclerotised strap along lateral face of vulval scale.

**Biology.**— Larvae found in rapid areas of small, cool streams. They have been found in moss on submerged rocks, and in leaf accumulations. Univoltine, with egg hatch in late Summer and Autumn; larvae, never abundant, mature in early summer.

*Diplectrona* spp. known from all regions except Ethiopian and Neotropical Regions, and Antarctic continent. Three species known in North America – two eastern, one western. One known from Canada.

*Diplectrona modesta* Banks

Map 74; Fig. 475–481

*Diplectrona modesta* Banks, 1908:266; Betten, 1934:182; Milne, 1936:68, 73; Ross, 1944:84; Wiggins, 1977:102; Schmid, 1980:Fig. 150-157.

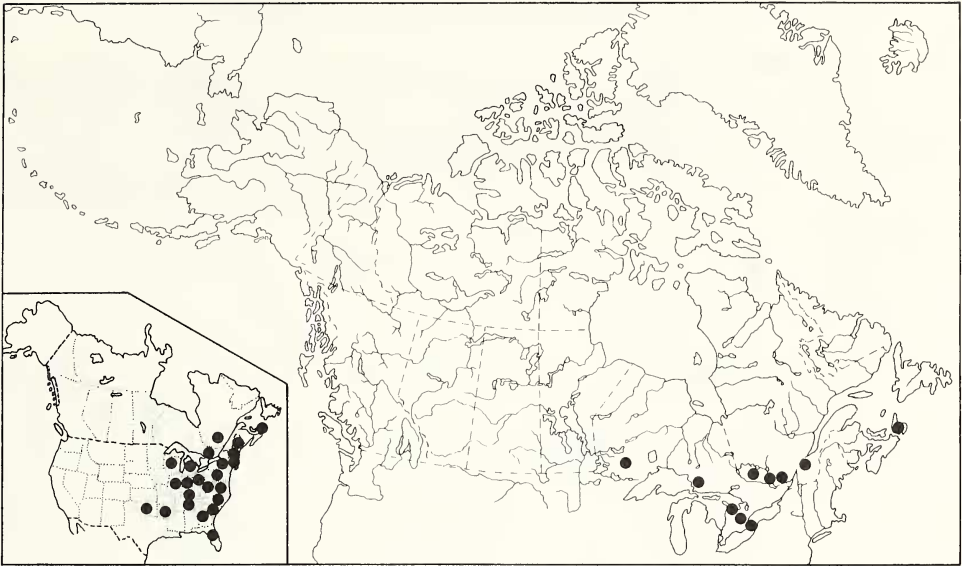
**Description.**— Male fore-wing length 8.74 mm; uniform grey-brown. Hind-wings palely tinted grey-brown. Antennae red-brown. Vertex dark red-brown. Spurs brown, dark brown in female; lateral member of fore-leg pair minute relative to mesal companion; equal in female. Thorax dark red-brown, to paler laterally. Legs dark straw-brown.

**Genitalia.** Male. (Fig. 475–479). (Specimen from St Hippolyte, Québec). Males distinguished by distal article of clasper of uniform width, much narrower than basal article (Fig. 475, 477); by dorsum of segment IX long; and by tergum X with two pairs of lobes, in dorsal aspect (Fig. 476).

**Genitalia.** Female. (Fig. 480–481). (Specimen from Milton, Ontario). Females distinguished by clasper receptacle located high on lateral wall of segment X as minute, circular pit (Fig. 480); and by vulval scale sclerotised strap long, widened distally, attached to basal angle of segment X by long, irregular root.

**Biology.**— As above, except to add that known flight season in Canada extends from May 30 to September 26.

**Distribution.**— Eastern seaboard of North America from Florida to Cape Breton Island, Nova Scotia, northwest to American mid-western states and northwestern Ontario. There are records from Arkansas and Oklahoma (Map 74). In Canada, recorded from near Dryden, northwestern Ontario, to Baddeck, Cape Breton Island, Nova Scotia, south to United States border.



Map 74. Collection localities for *Dipletrona modesta* Banks in Canada, with known distribution in North America by state or province.

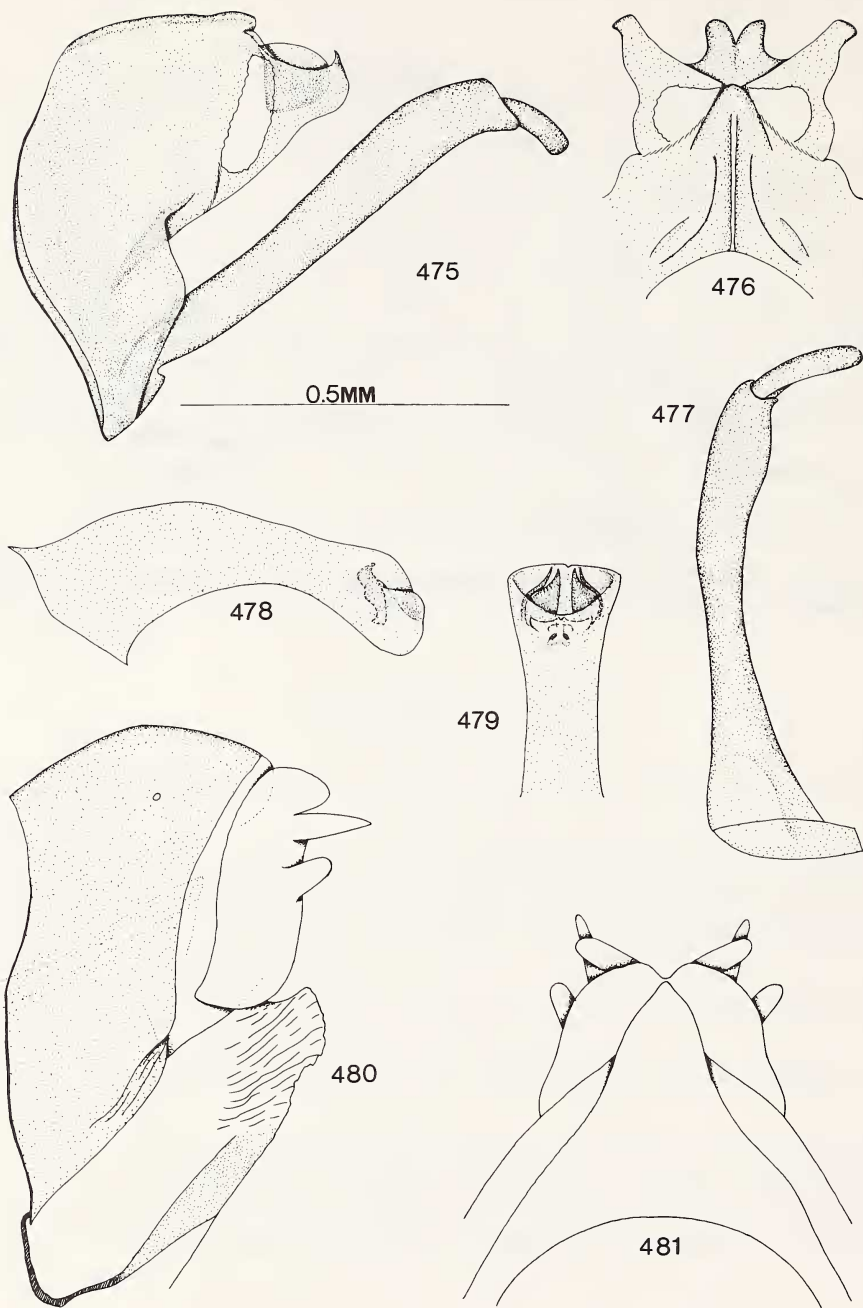


Fig. 475-481, *Diplectrona modesta* Banks: 475, genital capsule of male, lateral aspect; 476, genital capsule of male, dorsal aspect; 477, left clasper of male, posterior aspect; 478, aedeagus of male, lateral aspect; 479, aedeagus of male, dorsal aspect of tip; 480, genital segments of female, lateral aspect; 481, genital segments of female, dorsal aspect.

## SUBFAMILY MACRONEMATINAE ULMER

Macronematinae Ulmer, 1905a:41; Betten, 1934:200; Milne, 1936:67; Wiggins, 1977:93; Schmid, 1980:56.  
*Oestropsinae* Brauer, 1868. Denning, 1943:106, 155 (for Macronematinae).

As only one genus is at all likely to concern us here, the generic characterisation will suffice for purposes of this text. Those wishing full details of the subfamily should consult Betten (1934:200) and Wiggins (1977:93).

Genus *Macrostemum* Kolenati

Maps 75–77; Fig. 482–496

*Macrostemum* Kolenati, 1859; Flint & Bueno-Soria, 1982:358.

*Macronema* Pictet, 1836:400 (part); McLachlan, 1878:353 (part); Betten, 1934:203 (part); Milne, 1936:72; Denning, 1943:156 (*Macronemum*); Ross, 1944:114 (*Macronemum*); Bull. Zool. Nomen., 1962:80 (validation – opinion 623); Wiggins, 1977:110; Schmid, 1980:56.

**Description.**— Distinct secondary sexual dimorphism present. Head globular, vertex convex, malar space large. Antennae very fine, 1.5 times length of fore-wing, 1.3 times in female. Anterior warts of vertex very large, slightly less so in female. Maxillary palpi with two basal articles short; male flagellum 1.3 times longer than in female. Middle leg tarsi of female much enlarged, flattened. Hind-leg tibia of male with long setae. Male sternite V with finger-like lobe; minute bump in female. Wings sparsely hirsute; fore- and hind-wings of different shapes; fore-wing slenderly elliptical; hind-wing triangular, 1.5 times size of fore-wing, not so large in females; female hind-wing with distinct costal angle. Hind-wing venation somewhat irregular, incomplete. Fore-wing Sc and R1 joined prior to distal edge; fl-fV present, fl petiolate; discoidal, median cells small, thyridial cell very long, postcostal cell very large; A1 very long. Only flI, flIII, and fV present in hind-wing; R1 and R2+3 joined with Sc; discoidal cell open; M with origin at base of RS. Fore-wing variously banded transversely with light and dark colour.

**Genitalia.** Male. (Fig. 483–487, 490–494). Segment IX, in lateral aspect (Fig. 490), elongate; short dorsally and ventrally. Segment X comprised of two large lobes (Fig. 491), produced postero-laterad; meso-internal area membranous. Claspers (inferior appendages) long, of more or less uniform thickness, of two subequal articles. Aedeagus fairly stout basally, greatly swollen distally, simple (Fig. 493, 494).

**Genitalia.** Female. (Fig. 488–489, 496). Sternite VIII cleft twice on posterior edge, to form three lobes, or once to form two lobes (Fig. 489). Segment X roughly triangular in lateral aspect (Fig. 488, 496); ventral angle produced, vulval scale enclosed. Segment XI slightly developed; normal two papillate lobes of hydropsychids slender, distinct; space between lobes occupied by several smaller, papillate, membranous processes. Cerci small, of two articles.

**Biology.**— Larvae inhabit larger rivers, and ingest fine particulate detritus, phytoplankton, and bacteria.

*Macrostemum* is a widespread genus, found in Africa, Asia, Australia, with three species known from eastern North America.

Key to known or potential species of *Macrostemum* Kolenati of Canada

- 1a Wings pale yellow, with narrow, transverse brown stripes (more diffuse in female) ..... *M. transversum* (Walker), p. 174
- 1b Wings with longitudinal stripes (purplish brown) on basal part, transverse stripes distad of these, with irregular patch of brown on distal quarter of wing (more diffuse in females, with smaller patches of brown) ..... 2
- 2a (1b) Compound eye large relative to head in lateral aspect (Fig. 482), vertex low ..... *M. carolina* (Banks), p. 174
- 2b Compound eye small relative to head in lateral aspect (Fig. 495), vertex high ..... *M. zebratum* (Hagen), p. 174

*Macrostemum carolina* (Banks)

Map 75; Fig. 482

*Macronema carolina* Banks, 1909:342; Betten, 1934:204; Milne, 1936:73, 74; Ross, 1944:116 (*Macronemum*).  
*Macrostemum carolina*; Flint & Bueno-Soria, 1982:369.

**Description.**— Male fore-wing length 10.06 mm; purplish brown with large areas of yellow-brown disposed in longitudinal bars (basal) or transverse bars (mid-way to tip), with irregular patch in distal quarter. Female pattern more diffuse; dark areas paler distally, with distal quarter almost all pale yellow-brown. Hind-wing translucent pale brown, almost hyaline along costal edge. Antennae dark reddish brown. Vertex dark purplish brown. Spurs yellowish brown; lateral member of middle leg pairs, and hind-leg apical pair, notably shorter than mesal companions. Thorax virtually black, to very deep purplish brown laterally. Legs brown to yellow. Eyes large relative to head, malar space below not wide, rather narrow (Fig. 482). Vertex low in lateral aspect – this point will separate *M. carolina* from *M. zebratum*.

**Genitalia.** Male. (Not illustrated – identical to those of *M. zebratum*). (Specimen from Washington Co., Arkansas, USA). *M. carolina* and *M. zebratum* may be separated from *M. transversum* by segment IX and tergum X with membranous partial gap between, in lateral aspect (Fig. 490); and by tergum X distal lobes, in dorsal aspect (Fig. 491), with mesal edges parallel, gap between u-shaped.

**Genitalia.** Female. (Not illustrated – identical to those of *M. zebratum*). (Specimen from Washington Co., Arkansas, USA). *M. carolina* and *M. zebratum* may be distinguished from *M. transversum* by bases of cerci and lobes of segment XI enclosed laterally by postero-lateral edge of segment X; and by segment X wide from top to bottom (Fig. 496).

**Biology.**— South Carolina flight season is May to September. Wallace & Scherberger (1974) discuss larval retreat and net in detail.

**Distribution.**— Not yet recognised from Canada. In United States, recorded from most states from Oklahoma east to Florida, Illinois, and New York (Map 75).

*Macrostemum transversum* (Walker)

Map 76; Fig. 483–489

*Hydropsyche transversa* Walker, 1852:114

*Macronema transversum*; McLachlan, 1866:264; Betten, 1934:205; Milne, 1936:72, 74; Ross, 1944:117 (*Macronemum*);  
 Kimmins & Denning, 1951:120.

*Macrostemum transversum*; Flint & Bueno-Soria, 1982:369.

*Macronema polygrammatum* McLachlan, 1871:129; Betten, 1934:204, 205 (*M. polygrammaticum*); Kimmins & Denning, 1951:106 (as synonym of *M. transversum*).

**Description.**— Male fore-wing length 12.95 mm; pale yellow-brown with deep red-brown patches and bars; distal area of yellow-brown as transverse bar. Female fore-wing with dark patches more diffuse; distal transverse bar less distinct, extended to costal edge of wing. Hind-wing hyaline. Antennae pale orange-brown. Vertex very wide, short; deep red-brown, warts paler. Spurs yellow; lateral member of all pairs shorter than mesal companions; most noticeable on middle leg. Thorax deep red-brown throughout; venter clothed in long, very fine, hyaline pubescence. Legs straw-coloured; clothed in long, very fine, hyaline hairs.

**Genitalia.** Male. (Fig. 483–489). (Specimen from Altahana R., Appling Co., Georgia, USA). Males distinguished by pattern of sinuate, branched lines on segment IX and tergum X in lateral aspect (Fig. 483); by tergum X distal lobes, in dorsal aspect, separated by v-shaped gap (Fig. 484); and by no distinct division between segment XI and tergum X.

**Genitalia.** Female. (Fig. 488–489). (Specimen from Altahana R., Appling Co., Georgia, USA). Females distinguished by cerci and segment XI lobes entirely posterad of any overlap by lateral wall of segment X (Fig. 488); and by segment X narrow from top to bottom, in lateral aspect.

**Biology.**— No flight season data available. Wallace & Sherberger (1975) provide a detailed account of larval retreat and feeding net.

**Distribution.**— Not yet known from Canada. United States records scattered (Map 76), including Washington D.C., Virginia, Georgia, Indiana, and Ohio.

*Macrostemum zebratum* (Hagen)

Map 77; Fig. 490–496

*Macronema zebratum* Hagen, 1861:285; Betten, 1934:205; Milne, 1936:72, 74; Denning, 1943:157; Ross, 1944:115 (*Macronemum*); Wiggins, 1977:110; Schmid, 1980:Fig. 124-130.



*Macrostemum zebratum*; Flint & Bueno-Soria, 1982:369.

*Phryganea (Leptocerus) hieroglyphica* Harris – *nom. nud.*, invalid; Hagen, 1873:297 (as synonym of *Macronema zebratum*).

*Phryganea (Leptocerus) variegata* Harris – *nom. nud.*, invalid; Hagen, 1873:297 (as synonym of *Macronema zebratum*).

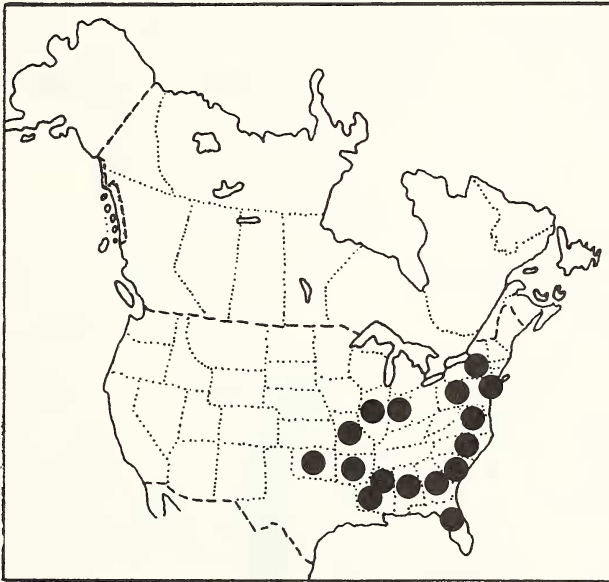
**Description.**— Identical to *M. carolina* (see *M. carolina* above). May be distinguished from *M. carolina* by eyes small relative to head (Fig. 495), malar space small, vertex high in lateral aspect. Also, *M. zebratum* is larger species, with fore-wing length of male 14.04 mm.

**Genitalia.** Male. (Fig. 490–494). (Specimen from Ile Ste Hélène, St Lawrence R., Montréal, Québec). Identical to *M. carolina*.

**Genitalia.** Female. (Fig. 496). (Specimen from Ile Ste Hélène, St Lawrence R., Montréal, Québec). Identical to *M. carolina*.

**Biology.**— Wallace (1975) reports on larval feeding, and net structure. Larvae inhabit rivers from large to very largest, found primarily in rapids. Canadian flight season ranges from June 1 to September 8.

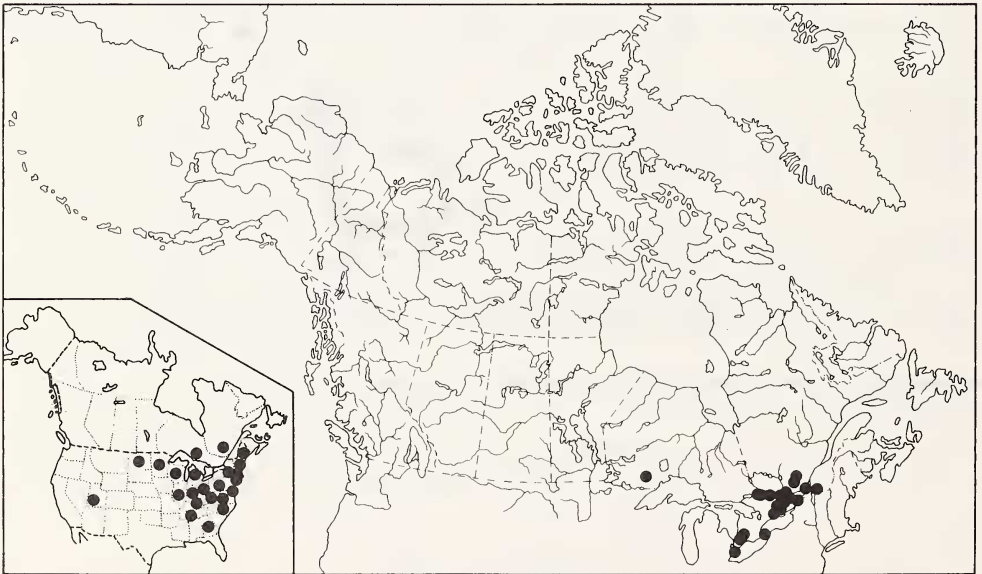
**Distribution.**— Other than a curious record from Utah, this species is confined to eastern North America (Map 77), east of line from North Dakota to Georgia. Recorded northeastward to Maine. In Canada, abundantly recorded from southern Québec and Ontario, with one isolated record from Ignace, far northwestern Ontario.



Map 75. Known distribution of *Macrostemum carolina* (Banks) in North America, by state.



Map 76. Known distribution of *Macrostemum transversum* (Walker) in North America, by state.



Map 77. Collection localities for *Macrostemum zebratum* (Hagen) in Canada, with known distribution in North America by state or province.

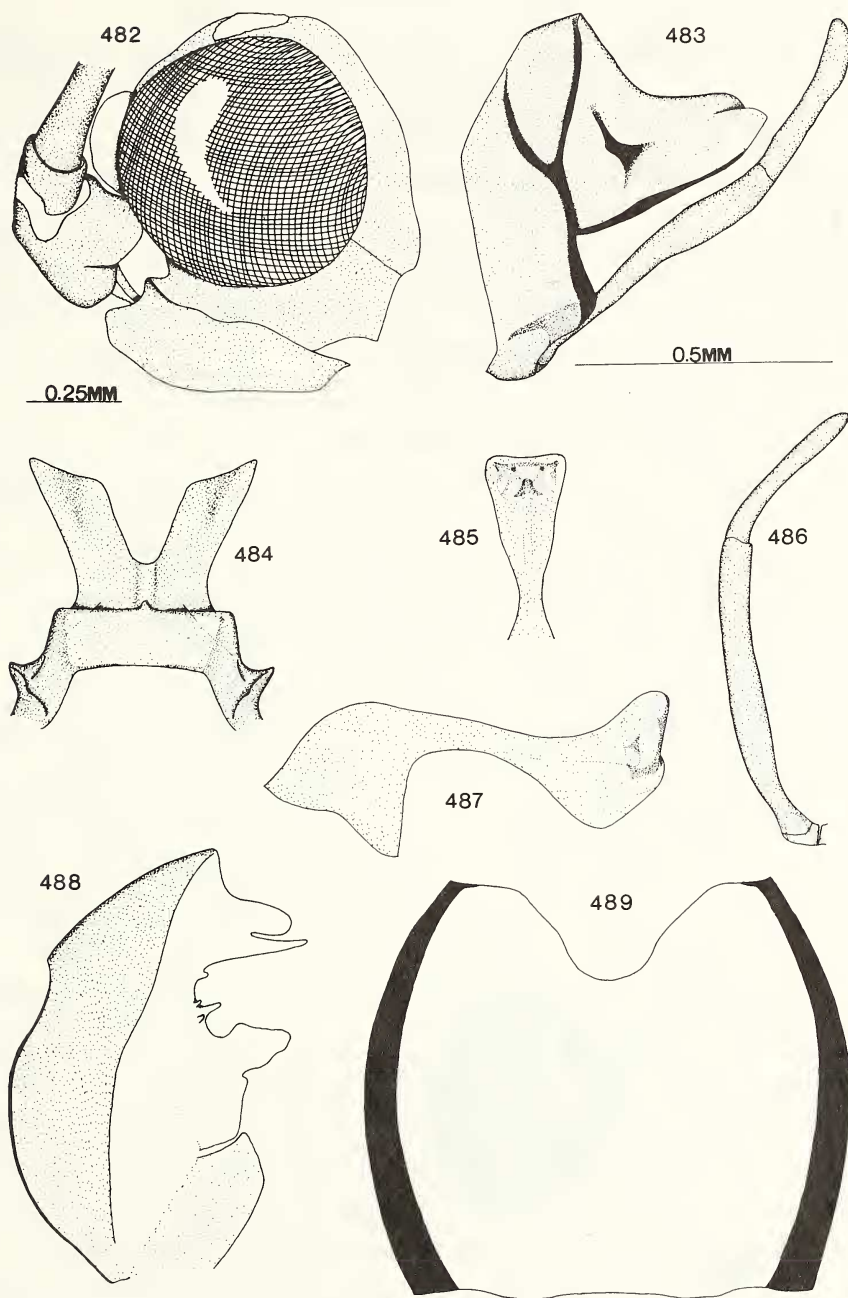


Fig. 482-489. 482, *Macrostemum carolina* (Banks): head of male, lateral aspect. 483-489, *Macrostemum transversum* (Walker): 483, genital capsule of male, lateral aspect; 484, genital capsule of male, dorsal aspect; 485, aedeagus of male, dorsal aspect of tip; 486, left clasper of male, posterior aspect; 487, aedeagus of male, lateral aspect; 488, genital segments of female, lateral aspect; 489, sternite VIII of females, ventral aspect.

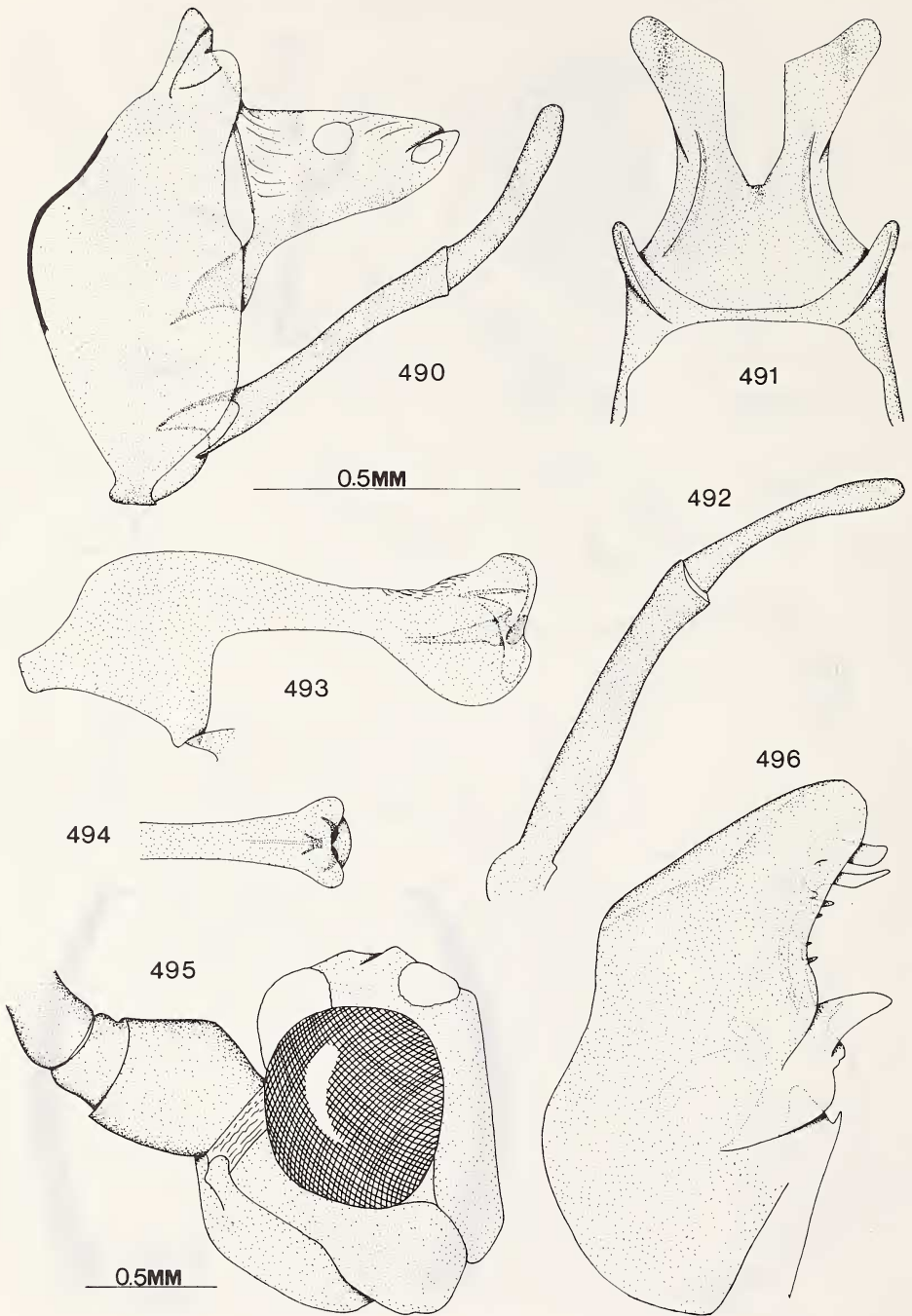


Fig. 490–496, *Macrostemum zebratum* (Hagen): 490, genital capsule of male, lateral aspect; 491, genital capsule of male, dorsal aspect; 492, left clasper of male, posterior aspect; 493, aedeagus of male, lateral aspect; 494, aedeagus of male, dorsal aspect of tip; 495, head of adult male, lateral aspect; 496, genital segments of female, lateral aspect.

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